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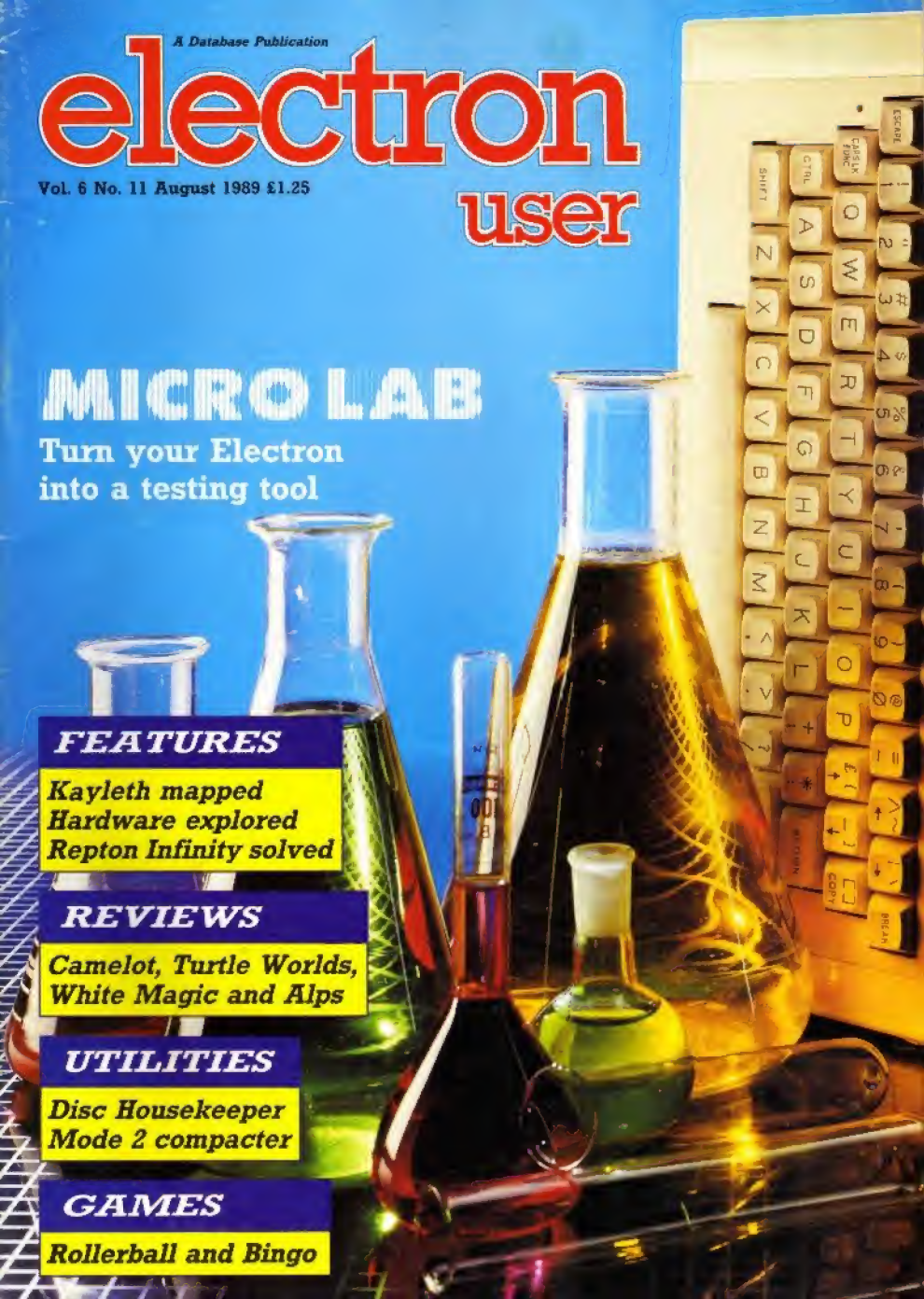

MICRO LAB

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FEATURES

Kayleth mapped
Hardware explored
Repton Infinity solved

REVIEWS

Camelot, Turtle Worlds, White Magic and Alps

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Mode 2 compacter

GAMES

Rollerball and Bingo

SCHWARZENEGGER

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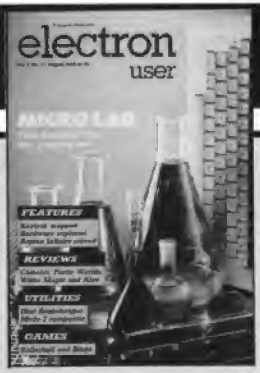

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Back to school
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Order on Page 45

If you want to start doing more with your micro than just playing games, this package is your ideal introduction to the four most popular applications for professional computers. All the programs have been designed for simplicity, so even a child can use them. Yet they include advanced features not yet available on programs costing many times as much!

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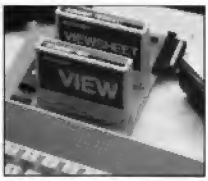

Software Bargains' Plus 1

Zooming in on art

IMPACT Software (0742 769950) has launched a new art package for the Electron which boasts a number of features promising to bring new artistic outlets for Electron owners.

Called The Art Studio, it is designed to help users produce top quality pictures with ease then save them to cassette or disc. These include zoom, copy, move, paint with 100 brush sizes, square, circle and rubberband

The Art Studio comes with clear, comprehensive instructions in a sturdy box with attractive packaging showing the kind of pictures that can be produced. Electron cassette version costs £9.95.

More 3D golf links

THE Fourth Dimension (0742 700661) has bowed to popular demand and produced two more courses to add to its Holed Out 3D golf simulation.

Each package contains two complete 18 hole courses and as the original Holed Out main program is included, it is not necessary to own the original game to play them.

Holed Out received a glowing report when reviewed in the June issue of *Electron User* and the new courses are said to be just as good as the original.

"We've had a lot of requests for extra courses and here they are", said Steve Botterill of The Fourth Dimension. "They're a lot trickier than the original holes and call for a dab hand to get round anywhere near par".

The two sets are called Holed Out Extra Courses, Volumes 1 and 2. Electron cassette version costs £9.95.

Business boost for the Electron

TO give Electron users a chance to try Acornsoft's business packages View and Viewsheet, Software Bargains has brought out its own cheaper version of the Plus 1.

The board, which comes without casing, is being offered in three packs. A basic pack bundles the complete PCB with one cartridge port, plus word processing package View and spreadsheet Viewsheet, for £29.95.

An extended version includes the PCB with one cartridge port and a printer port with View and Viewsheet for £36.95 and the full pack has two cartridge ports, enabling users to add a disc drive at a later date, a printer port plus View and Viewsheet for £39.95. Upgrades will be available for up to 12 months after the date of purchase. From basic to extended costs £15, from basic to full costs £20 and from extended to full costs £12.

"In essence, we are really trying to sell the benefits of View and Viewsheet. The expansion board is merely a means to this end, but we feel we are breaking barriers in people's minds in terms of price", said Ruth Sutcliffe for Software Bargains.

"We are calling this an exclusive business/education offer for Electron owners because we've calculated that of the approximate 200,000 Electrons in the UK, perhaps as many as 150,000 owners have not yet been able to acquire or use View or Viewsheet.

Setting the seal to the new partnership between leading electronic mail company MicroLink and Britain's newest data communications giant Istel Inet are (left to right): David Bromley, sales director and David Underwood managing director, Istel Inet with Derek Meakin, chairman, and David Hirst, commercial director, MicroLink.

Growing partnership

MAJOR changes are being planned for MicroLink, the rapidly growing electronic mail service

It will leave Telecom Gold and enter into a partnership with Istel Inet, the new telecommunications giant. Istel Inet is a partnership of two major international names in the field of data communications, Istel and Bell Canada Enterprises.

"We have long been faced with restrictions that have prevented us developing the service in the way we know our subscribers would like", said MicroLink chairman Derek Meakin. "We feel that the time has come to break away from Telecom Gold and open new doors.

"The result will be a considerable expansion of services available to anyone with a computer, a modem and a telephone".

Many of the present facilities offered by MicroLink will be improved and the new service will also include news, sport and weather, a comprehensive financial section plus online shopping. Computer conferencing, a service long requested by MicroLink subscribers, will also be introduced.

Warning for pirates

ELECTRON games will soon bear a new symbol as a warning against copying. Taking the next step in its battle with piracy, FAST, the Federation Against Software Theft, is hoping to persuade software houses to use a common warning symbol. Liverpool-based Psygnosis has offered to design the symbol free of charge. It will feature the internationally recognised red circle with a diagonal slash and may include a picture of a pirate.

Gallup Software Chart

THIS MONTH	LAST MONTH	TITLE (Software House)	COMMENTS	PRICE
1	2	FRAK! *Aardvark*	A good five years old now, this game from Orlando was one of the first for the Electron. Definitely a collector's piece.	7.95
2	11	LAST OF THE FREE *Audiogenic*	Yet another title which has not been in the charts for some years, but it still selling well even at full price.	7.95
3	1	STORMCYCLE *Atlantis*	Save the Earth from imminent invasion and disaster by finding five diodes, killing the enemy and beating the clock.	1.99
4	•	CRAZEE RIDER *Blue Ribbon*	Enjoy the thrills and spills of high-speed motorbike racing. Fast, furious and originally a full-priced game from Superior Software.	2.99
5	6	JOE BLADE 2 *Players*	The graphics are good and the game is very playable. The puzzle screens are wicked and will keep you busy for hours.	1.99
6	•	DEAD OR ALIVE *Alternative*	Prepare for a shoot out at the OK Corral. It's dusty and hot – can you survive and retain your position as town sheriff?	1.99
7	12	INDOOR SOCCER *Alternative*	A simple game at a budget price. Good value and well worth a look. Though nothing spectacular, it is competently executed.	1.99
8	3	COMMANDO *Encore*	A Rambo-style shoot-'em-up against the odds. Now on a budget label, but you can also buy it as part of Play it Again Sam 3.	2.99
9	•	OLYMPIC SPECTACULAR *Alternative*	You have a couple of more years to wait for the next Olympics, so this could be just the time to get in some training.	1.99
10	7	GRAHAM GOOCH TEST CRICKET *Alternative*	Originally released by ASL, it is more suited to its budget price. Only recommended if you can't wait for the next Test.	1.99
11	•	PLAY IT AGAIN SAM 9 *Superior*	A new arcade adventure called Camelot joins Spycat, Steve Davis and Repton in this superb compilation.	9.95
12	•	CRAZY ERBERT *Alternative*	Bounce down a pyramid, painting as you go, but watch out for the gorilla's banana and unscrupulous snakes.	1.99
13	•	THRUST *Firebird*	An old favourite which is deceptively simple. Thrust has been keeping people glued to their seats for years with its skillful gameplay.	1.99
14	•	ZALAGA *Aardvark*	Looking like eratic bees, the aliens swoop towards you in formation. Winning is simple – destroy them before they destroy you.	9.95
15	•	CITADEL *Blue Ribbon*	A great way to start a games collection if you are new to the Electron. Originally full-priced, it is a superb arcade adventure.	2.99
16	•	TURF FORM *Blue Ribbon*	After the good weather at Royal Ascot you may feel lucky – if so, this one will test your skill. All you have to lose is £1.99.	2.99
17	•	CROAKER *Micropower*	Similar to Frogger, Hopper and the rest – you must manipulate and manoeuvre your frog back to its home pond. Fast and tricky.	2.99
18	•	GHOULS *Micropower*	Also available on Sam 7. Good use is made of sound and graphics in this simple levels game set in a mysterious mansion.	9.95
19	•	KILLER GORILLA *Micropower*	There is little which can be said about this classic which hasn't been said before. If you haven't seen it – buy it.	9.95
20	•	BUMBLE BEE *Program Power*	A variation on the Pac-Man theme. You collect pollen while being chased by spiders, but you can rearrange the maze to cut off their attack.	1.99

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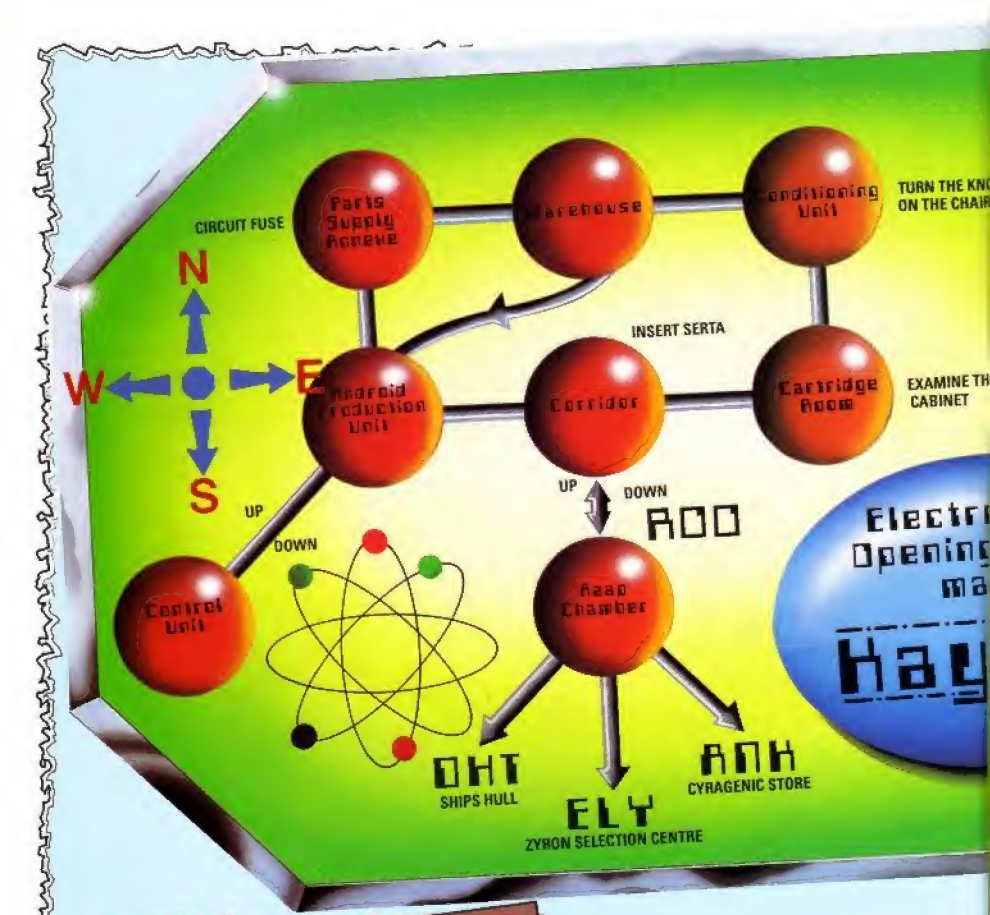

Adventures By Pendragon

The hero with a creator

THIS month's column is something of a special, as I bring you a full review of Alpine's much awaited and excellent rom-based adventure creator Alps. This review has been prepared by Paul Waterman, long time correspondent and author of Reluctant Hero.

First let's catch up with the gossip which has flowed over the castle walls since last we spoke. Perhaps the biggest and most pleasant surprise was a scroll I received from that master adventure creator Steve Maltz. He wrote to say that despite the fact that Shards no longer produces text adventures, he still reads this column every month and wishes to send his best wishes to all Electron adventurers.

He explains that Shards Software is now involved in producing interactive business training software for IBM PCs. Despite that, the back catalogue of Shards' excellent Electron adventures such as Pettigrew's Diary, Woodbury End and Operation Safras are still available from mail order firms.

A letter from Steven Kelk also caught my attention. He queries the fact that in the past I mentioned that Geoff Larsen gave Hex its title because it was his sixth adventure, and Hex is the Greek word for six.

Steven has apparently searched and can only uncover five adventures by Larsoft. So to put you out of your misery and help other folk who are searching, here is a full list of all Larsoft adventures:

1. The Prophecy
2. Return of the Warrior
3. Wychwood
4. The Nine Dancers
5. The Puppet Man
6. Hex

Another missive from Kerry Kirwan should be of interest to all readers. She writes that a new adventure software company for the Electron has just been formed called Tiger Soft. It is currently developing a 300 location epic titled The Magic of Merlin. It is due for pre-Christmas release and I await a review copy with suitably baited breath.

Erstwhile contributor Barbara Gibb deserves mention and my thanks for her full solution to that adventure oldie, Seek. This is one game I never finished, so am most grateful for her help. Barbara also offers a unique playtesting map to Aussie Suds for which I would also be indebted.

I won't keep you from the Alps review much longer, but finally let's mention this month's featured map. It is of the opening scenario to Adventure Soft UK's Kayleth and ought to help many adventurers who are stuck at the outset of this excellent sci-fi jaunt.

Next month I continue this series with a guide to the openings to Epic's classic, Quest for the Holy Grail.

● *That's it for this month, so until icicles form on the keyboard, happy adventuring.*

Climbing icy mountains

THE Electron version of Alps – Alpine's Adventure Language Programming System – has recently been converted from the original BBC Micro program. Alpine says: "Necessity being the mother of invention, we have actually squeezed in more features than the BBC Micro version has".

This adventure creator package includes a 16k rom, user guide, keystrip and either disc or cassette of utilities and sample adventures. As Alps is a rom-based utility, you will need either a Plus 1 and blank rom cartridge or Rombox. To evaluate the system, I converted my Quilled adventure Reluctant Hero into Alps.

An adventure program created by Alps is made up of a list of rooms and objects, along with the program logic to handle them. The object and room descriptions and properties are stored in easy-to-use tables.

Up to 150 objects, and 255 verbs and synonyms can be defined. Each room and object has eight flags and a state value. Memory is set aside for them at the start, unlike the Quill, where the more objects or verbs you use the less memory there is available for the game.

Any object can be a light source and all or just some of the objects can be breakable, magnetic, heavy or sharp. The object's flags can be changed in the logic part of the program so that a blunt knife can be sharpened.

The object's state can be linked to messages so that a knife could be described as "A long jewelled knife with a sharp edge", "A long jewelled knife with a blunt edge" or "A long jewelled knife with a broken blade".

To save memory, the "A long jewelled knife with a" is the same in each instance, with the alternatives tagged on depending which switch is active in the object description.

Another memory-saving device is the hash symbol. Whenever it appears a predefined message is placed at that point. Any number of hashes can be used to reduce the text.

The technique can be used for the 150 possible locations, and any room can be designated as airless, flooded, poisonous and so on. The room state can be used to alter the description.

Automatic text formatting ensures that words are not split over lines, so there aren't any worries about how messages appear.

Text compression must be done manually and I found this difficult to do effectively. Efficient automatic text compression is available on the extras disc or tape. It took about one minute to compress all the text in Reluctant Hero.

The optional extension disc allows you to produce large adventures by holding all the text on disc. Games can then have up to 255 locations. With the extras disc you can compress the text by up to 60 per cent.

Also, more predefined verbs such as GET ALL and DROP ALL are added, and a container is provided in which objects can be placed or removed. These verbs can be programmed using

Turn to Page 11 ➤

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◀ From Page 9

Alps, but the Extras disc does it more efficiently.

A special starter program provides verbs like TAKE, DROP INVENTORY and the directions.

Standard movement is N, S, E, W, UP and DOWN, though you can program the game to accept any other direction, but at a cost – the more non-standard directions used the more memory will be needed to program them.

A useful feature is that each room has an exit routine for each standard direction, allowing you to have a conditional exit like a locked door or secret passage.

Before the player is moved the exit is checked to see if there is a special routine for it, and if so whether it allows movement at that time. If it doesn't the player isn't allowed to proceed and a message can be given explaining why.

Automatic exit reporting is enhanced compared to the BBC Micro version. Every time a room is described Alps looks at every connecting room and reports that "There are exits north to MSG and south to MSG" where MSG is the text in the room data table.

There are only 50 integer variables, compared to 64 in The Quill, but there are also eight On/Off flags and one state with a value of up to 255 for each object and room.

This leads to one of the problems of Alps – trying to debug the logic. With The Quill the game can be run with all of the flag values displayed, but Alps would have to display 2,700, which is not feasible.

Most of the familiar adventure keywords are present, but sometimes different words are used. Some common keywords are missing, among them are CLS, DROP, GET, and PAUSE. However, DROP and GET are defined in the special Starter file, which means you can redefine how they react to a particular situation. Instead of printing OK you could have different messages for each object – memory permitting of course.

PAUSE can be programmed by using procedures. The delay is easily set by making the program loop a number of times. I found the loss of CLS to be irksome, but as I became more used to Alps I found I didn't miss it as much.

All the flags can be set to zero or one wherever you are, so an action in one room or on one object can change the flag in another room or object. The state of an object or room can be incremented or decremented so allowing progressive changes.

Whole sentences can be typed by the player and either the first recognised verb and object can be acted on, or by extra programming, the whole sentence can be analysed and acted upon.

The on screen editor used in entering the logic part of the program is only a simple line editor rather than a full screen version. The function keys are used to enter the object, room and text editor as well as for inserting/deleting lines and text compression.

The utilities allow you to create stand-alone games that can be run without the Alps rom, print the room and object data lists and the text.

You can also examine two sample adventures, one small one with seven rooms and six objects, and a larger one with 50 rooms and 90 objects. You can play both of the games and access the data files so that you can see how they have been constructed.

The user guide is a 38 page booklet which is, for the most part, easy to understand, though I felt the section dealing with writing the logic part of the adventure was not basic enough. The rest of the sections were well explained, particularly the one on sentence analysis.

Alps is superb value for money and well supported by Alpine whom I found very helpful whenever I stumbled.

Paul Waterman

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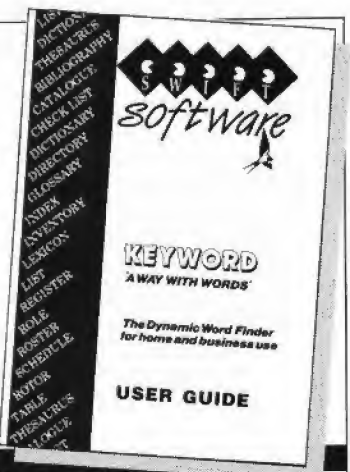

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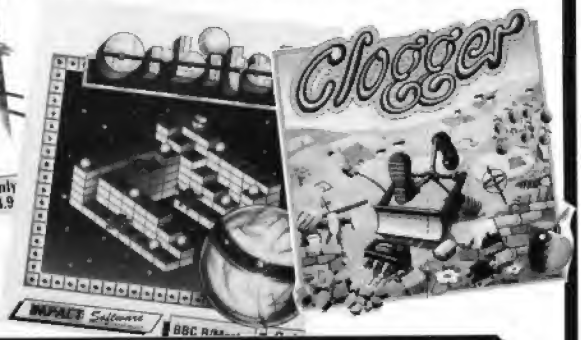

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An add-on software package designed to improve Logo's rather unfriendly interface is given a thorough classroom workout by Roger Frost

A smile on the face of the turtle

ONE of the main problems experienced by teachers when trying to encourage pupils to enthuse over Logo is the language's decidely unfriendly startup prompt. The Logotron version – which is now the standard – simply presents a question mark as a prompt, which can be a stumbling block for some pupils who then don't know what to do next.

For them, Turtle Worlds – the company and the product have the same name – may well provide the answer. It runs on the Electron providing you have an AP4 disc interface.

Logo, a very powerful computer programming language, is set to form part of the national curriculum for many schools. The Logotron version has many in-built extensions like control and music, but many teachers are alarmed about how their pupils will cope with any variant on the basic Logo theme.

Now Turtle Worlds transforms the appearance of the language into something bright and colourful by allowing users to work on screens loaded as backgrounds.

The package consists of two discs and a very well written manual. The aim of authors Richard Parker and Chris Morley is to make Logo accessible and easy to use. All that is needed is to insert the main disc, press Shift+Break and let the software set itself up. After a short wait a very pleasing Turtle screen loads, followed by the main program.

The menu displays a list of the ready made screens provided on the disc. These pictures are based on a supermarket theme, with a plan view of the car park, the front of the shop, a plan of the inside, shelves, tins of peas, some fruit and a final picture of loading the car with shopping.

These screens are only the beginning, as it is easy to create your own and add them to a Turtle Worlds Library disc. User friendly utilities are provided to convert raw screens to Turtle Worlds format.

There are three other main features, the first being the extra Logo Keywords provided:

- SETCOL allows screen colours to be altered and is equivalent to the Basic VDU 19 command, but much easier to manage. This is required to allow Turtle World screens to be displayed in the colours they were originally painted in.
- RESET sets all colours back to their default values.
- PANIC will regain work space at the expense of defined procedures. This could be a life saver for Logo users.

The other two features are designed to make the user interface easier to manage. The first, simple method is to define function keys with the more frequently used Logo keywords. The second technique is to set up a Concept keyboard.

An A4 sized overlay is provided with the pack. It can easily be photocopied and enlarged for A3 size keyboards.

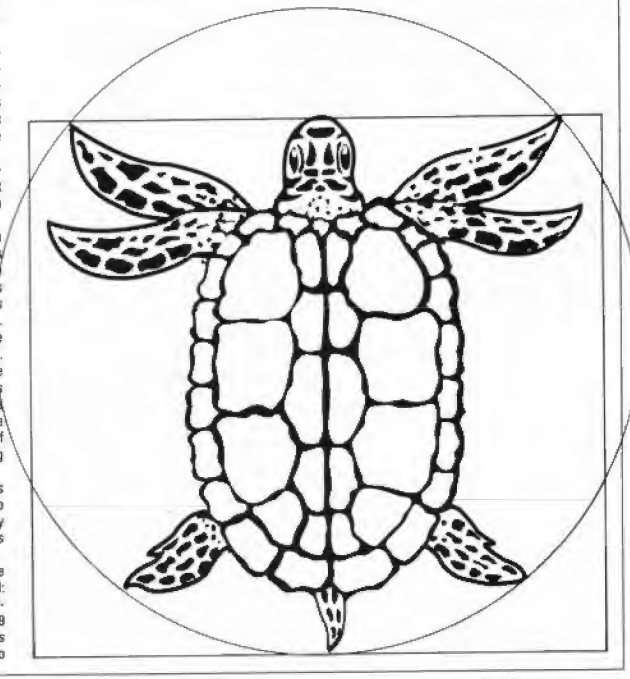
The best part of Turtle Worlds is the section in the manual devoted to ideas for its use. Although simple, they will set youngsters thinking about geometry without realising it as they perform some other task. An example involves the car park plan. One suggested idea is to move the turtle along roadways to an empty parking lot and then to construct a simple plan view of a car.

Changing the colour of items on screen – a satisfying process – will require the turtle to be placed inside the object. Distances and angles will need to be estimated here. A particularly popular idea is to colour the fruit so that it looks bad.

A pity the printer option is for black and white Epson-compatible devices.

Turtle Worlds could be the way to bring any school's Logotron Logo to life. It is thorough, very user friendly and an absolute snip at £12. Recommended.

Product: Turtle Worlds
Price: £12.00
Supplier Turtle Worlds, 7, Springwood Road, Leeds LS8 2NA.



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Product: White Magic
Price: £9.95 (Tape)
Supplier: The Fourth Dimension, PO Box 4444, Sheffield.
Tel: 0742 700661

High adventure

WHITE Magic is the latest release from the new software house The Fourth Dimension, and it's excellent. It takes the best features from several arcade adventures blending them into one blockbuster of a game. In many ways it's reminiscent of the arcade game Gauntlet.

In it you must survive and progress through 32 game levels, each with its own theme. There are aggressive guards, trolls, ghosts and spectres to destroy, objects to find and use – and some to avoid, too. Transporters whizz you to different parts of the screen and have to be used correctly in order to complete the level.

You have a choice of four characters, each with its own special powers, strengths and weaknesses, and can swap between them at any point in the game by pressing the keys 1 to 4 to deal with each danger and puzzle.

Kaldor the leprechaun can run very quickly – sometimes the best defence is to beat a hasty retreat – and can climb over tree trunks that block your route. Cheysul the titan is a powerful axe-wielding barbarian who slays all in his path. He can also push objects aside.

Moriana the warrior lacks Chesul's great strength, but makes up for it with body armour, a shield and razor sharp sword. Mandrake the enchanter is endowed with magical powers and is able to use potions to weaken and dispose of his assailants.

Each character has its own armour rating, weapon strength, magical power and health, attributes which are constantly displayed onscreen to the left and right of the central playing area.

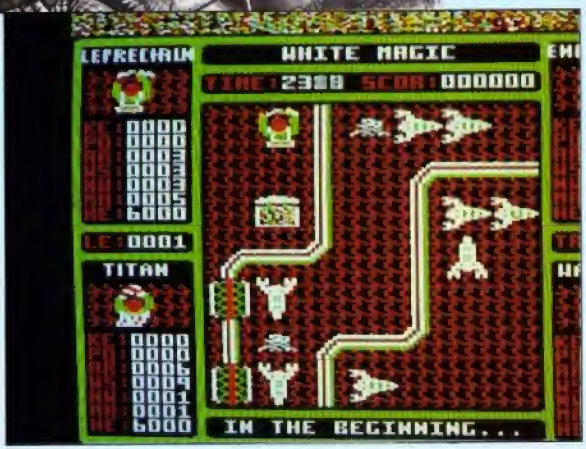
As you explore each level you'll come across objects that can be put to good use in your quest. Some increase a character's strength, others add to Mandrake's supply of potions, shields build up your armour, swords aid your combat ability and so on.

The game closely resembles Superior's Ravenskull, but unlike that arcade adventure, here the action comes thick and fast and the emphasis is on battling adversaries and solving puzzles.

The action takes place in a window occupying about half the screen. You can only see a small portion of the total playing area. As you move to the edge of the screen it flicks rapidly to the next – not scrolling like Ravenskull. This means you can't see what objects or assailants lie just off screen, waiting for you to step into their trap.

The graphics are superb, but the sound effects are minimal. However, this doesn't detract too much from the otherwise excellent gameplay. If you are on the lookout for a new arcade adventure challenge White Magic fits the bill nicely.

Janice Murray



Sound	5
Graphics	10
Playability	10
Value for money	9
Overall	9

SecondOpinion

Arcade adventures are being released thick and fast, and all are top quality offerings. White Magic, is no exception and soon had me hooked.

With its unusual feature of multiple characters, puzzles, variety of foes and action-packed gameplay it will take quite some time to master. An absolute winner.

Roland Waddilove

GOLDEN electron user GAME

Cool hand Sam

Product: Play it Again Sam 9
Price: £9.95 (tape)
Supplier: Superior Software, Regent House, Skinner Lane, Leeds LS7 1AX.
Tel: 0532 459453

PLAY it Again Sam 9 could probably be best described as the Superior collection for the more sedentary gamester. Consisting of three arcade adventure games and a snooker simulation, it is hardly the most exhilarating of compilations.

First is **Spycat**, a tongue-in-cheek tale of espionage and intrigue in the corridors of power. After 50 years' loyal service Spycat hears rumours concerning his forthcoming retirement – due to government cut-backs his comfortable pension is to be slashed. Angered by the thought of impending poverty, Spycat decides to take out a little insurance in the form of three top secret research documents.

Your mission is to help Spycat to locate the documents, copy them to microfilm, obtain all of the relevant travel papers to escape to Greenland, fly there and write his memoirs and probably have them banned by the government.

Despite limiting himself to four colour Mode 5 the programmer has managed to create an impressive series of cartoon-like characters and backdrops – Spycat is a superb Paddington Bear lookalike with a penchant for flashing when ignored for a few minutes. The game was a most enjoyable romp the first time around, and now constitutes a worthy addition to the ever expanding Sam series.

Snooker is a game that has yet to be realistically implemented on the computer screen and **Steve Davis' Snooker** is the epitome of all that is wrong with this type of simulation. The balls are too small to allow for the accurate judgement of angles. Also, the micro is unable to keep track of such a large number of moving balls and as a result the speed varies according to the amount of onscreen activity.

It is played in complete silence and the micro-operated opponent manages the most impossible of shots with uncanny accuracy.

Why anyone would want Sam to play it again I don't know.

The third game involves that mainstay of the Superior stable, **Repton**. No compilation seems complete without it these days. Starring in his autobiography – The Life of Repton – our green-skinned reptillian buddy must negotiate 40 testing screens of fiendish action.

Based around the classic Repton 3 program, the new collection of screens calls upon the different stages of Repton's life as a source of inspiration. The traumas of infancy form the basis of the first eight. In his search for missing teddy bears baby Repton is hounded by monster dogs and is likely to be crushed by the tumbling Humpty Dumpties.

Many lives will be lost in your first few attempts due to a lack of familiarity with the new game characters. To assist you Superior has thoughtfully provided a character comparison chart, with which you can determine which of the new characters corresponds to the eggs, diamonds, boulders and so on before you do something silly.

The subsequent stages of Repton's life story include school days, teenage traumas, work and his twilight years as an ageing reptile. The game's strength has always been its strategic content: Each screen conceals unknown terrors for the player. You are always aware that a single misplaced boulder can render a screen completely unplayable.

The Life of Repton is by far the best program in this latest compilation – it even includes the screen designer utility.

Sam's final offering is the classy, colourful and previously unknown arcade adventure called **Camelot**. Your quest as King Arthur in this mythological tale is to search for Excalibur and use it to defeat a fiery dragon. You are hampered by the imposition of a time limit and the fact that nobody appears to respect you any more, the castle being overrun with witches, devils and enemy knights.

You have a single life, the duration of which is determined by the state of your energy level. Physical hazards such as fire, water and banks of vicious pointed spears place a tremendous strain on your wellbeing.

You are able to wipe out most of your enemies, with your trusty zapper until, that is, you run out of zap. The meagre 50 rounds you begin with are soon expended and new supplies are hard to locate. On the positive side your rapidly diminishing energy reserves can be replenished by opening one of the strategically placed treasure chests. First rate graphics and difficult gameplay make Camelot a suitable challenge for even the most accomplished arcade adventurers.

If you are looking for a compilation that gets away from the frenetic keyboard bashing of the Firetrack and Galaforce variety then get yourself a copy of Sam volume 9. With the exception of Mr Davis' contribution, good old Sam's done it again.

Jon Revis

Sound	5
Graphics	8
Playability	8
Value for money	8
Overall	8

SecondOpinion

Sam's now playing it for the ninth time in this excellent compilation of hit games. The weakest is Steve Davis' Snooker, and the most outstanding Camelot – a new and challenging arcade adventure that's sure to have you hooked.

Forget the other games – they can be considered freebies – the main attraction is Camelot, I loved it.

Roland Waddilove

Camelot is an arcade adventure in the style of Citadel

Try your luck against the mighty Steve Davis

Disc spring clean

All the most used ADFS disc utilities are now available in a single package courtesy of Leslie Goodridge's Disc Housekeeper

DISC Housekeeper is a menu-driven machine code program which brings together all the most used disc filing system commands into one easy-to-use utility. It enables you to delete files from any directory, change a file's access status, change directories and compact the disc, rounding up any free space. During this the catalogue or free space map is constantly updated and displayed on-screen.

Every disc user will have seen the dreaded error messages *Directory full* and *Compaction required*. It means, among other things, that it is about time you got around to removing all those unwanted files and sorted your disc out.

Although both the ADFS and DFS have commands which enable you to do this, it is a tedious and repetitive job which always seems to be put off until another day. Disc Housekeeper makes it quick and easy to keep your discs tidy.

Although designed primarily for the ADFS, the utility will reconfigure itself for use with the DFS. It works quite happily with the Pres E00 DFS and the Plus 3. It will also work with other DFS systems having *MAP and *FREE commands. The Pegasus DFS uses *STAT in place of *FREE, but substituting this in the listing will ensure compatibility here too.

If you have a disc toolkit rom you may find that it may have to be disabled before using the program. The ADT rom from Pres, for example, causes the code to crash during DFS – but not ADFS – compaction unless it is first switched off.

Type in the program and save the assembler source code before running it. Once assembled, the machine code will be saved on disc automatically with the filename HK. A short name like this can be quickly called up from your utilities disc with a star command like *HK.

Once Disc Housekeeper is running you will see the main menu offering three options: New disc, Delete files and Compact disc. Pressing Escape at any time, except during compaction, always returns you to this screen.

When used with the ADFS, the first option will *MOUNT a disc. This isn't necessary with the DFS, so nothing will happen.

On selecting the second option, to delete files, the currently selected directory (CSD) will be displayed together with a sub-menu offering three further options.

If the directory is full, the disc title and the first few files will scroll out of the text window. Holding down Control+Shift prevents this.

The three sub-menu options are: Delete from CSD, Change directory and Change access. When you select the second or third options a flashing cursor prompts you to enter the relevant data. Pressing Return then executes the command. A maximum of 14 characters may be entered, with Delete having its normal function of correcting mistakes.

Selecting the first option – Delete from CSD – will enable you to delete files from the currently selected directory. You will see the prompt: *Delete Y/N?* followed by the filename. Press Y to delete it or N to leave it. Continue deleting files or return to the main menu by pressing the Escape key.

It is easy to move around directories deleting files as you go. Locked or empty directories can have their access status changed with option three – Change access – ready for deletion.

Once you have finished deleting, return to the main menu by pressing Escape and select Compact disc. The free space map and the number of bytes free will be displayed. Press Y to compact or N to abort.

An updated free space map will be displayed after compaction. If there is still more than one entry you may need to compact again. Press Escape to go to the main menu and then select option three – Compact – again.

If you try to delete a locked file or a directory with files in it an error will be generated. To prevent a crash Disc Housekeeper has a built-in error trapping routine. This first displays the source of the error and then waits for Escape to be pressed before returning to the main menu.

Press the Break key to exit the program.

The assembly listing should be easy to follow as it is liberally sprinkled with meaningful labels and is written in a structured manner. All the filing system commands are performed using oscli.

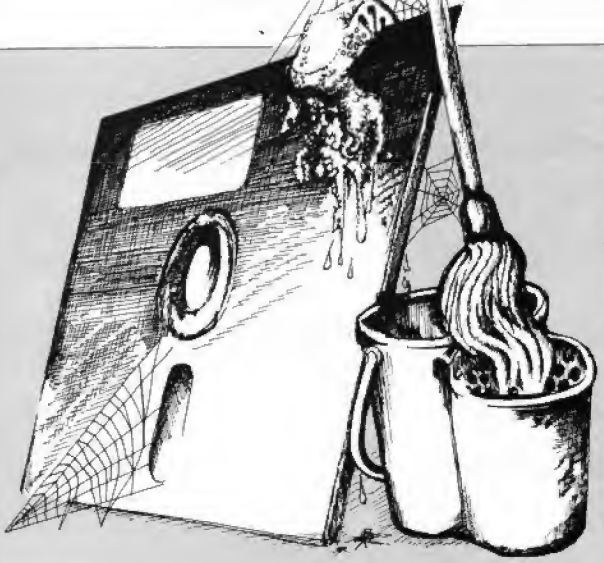
To ensure compatibility between the ADFS and DFS the *COMPACT command is altered as the syntax is different for each one. The machine code is stored in memory from &880 to &CF7.

You should find Disc Housekeeper very useful, as it combines all the most used disc filing system commands into one easy-to-use utility. You no longer have any excuse for not keeping your discs in order.

Turn to Page 18 ▶

◀ From Page 17

```
  10 REM Disc Housekeeper
  20 REM By L J Goodridge
  30 REM (c) Electron User
  40 :
  50 brkvec=&202
  60 osrdch=&FFE0
  70 osgbpb=&FFD1
  80 osargs=&FFDA
  90 osnewl=&FFE7
 100 osbyte=&FFF4
 110 oswrch=&FFEE
 120 oscli=&FFF7
 130 commandstring=&70:REM &70-&
82
 140 temp=&83:REM temp+1=&84
 150 block=&85:REM &85-&91
 160 address%=&880
 170 :
 180 FOR pass=0TO3STEP3
 190 P%=address%
 200 [OPT pass
 210 .setmode4
 220 LDA #22:JSR oswrch
 230 LDA #4:JSR oswrch
 240 :
 250 .disablescape
 260 LDX #&FF:LDA #229
 270 JSR osbyte
 280 :
 290 .cursorkeysoff
 300 LDX #1:LDA #4
 310 JSR osbyte
 320 :
 330 .setuperrorcode
 340 LDA #errorroutine MOD 256
 350 STA brkvec
 360 LDA #errorroutine DIV 256
 370 STA brkvec+1
 380 :
 390 .setfordfs
 400 LDY #0:TYA
 410 JSR osargs
 420 CMP #4:BNE notdfs
 430 LDA #13:STA discompact+4
 440 .notdfs
 450 :
 460 LDA #title MOD 256
 470 STA &F8
 480 LDA #title DIV 256
 490 STA &F9
 500 JSR print
 510 JMP menurentry
 520 :
 530 .newdisc
 540 JSR window0
 550 LDA #newdiscmess MOD 256
 560 STA &F8
 570 LDA #newdiscmess DIV 256
 580 STA &F9
 590 JSR print
 600 .getreturn
 610 JSR osrdch
 620 .checkesc
 630 CMP #27:BEQ menurentry
 640 CMP #13:BNE getreturn
 650 .checkifdfs
 660 LDY #0:TYA
 670 JSR osargs
 680 CMP #4:BEQ menurentry
 690 .adfs
 700 JSR mountdisc
 710 :
 720 .menurentry
 730 LDY #0:JSR cursoroff
 740 JSR window0
 750 LDA #menu MOD 256:STA &F8
 760 LDA #menu DIV 256:STA &F9
 770 JSR print
 780 .getchoice
 790 LDX #0:LDA #21
 800 JSR osbyte
 810 JSR osrdch
 820 CMP #"1":BEQ newdisc
 830 CMP #"2":BEQ deletefiles
 840 CMP #"3":BEQ compact
 850 JMP getchoice
 860 :
 870 .deletefiles
 880 LDY #0:JSR cursoroff
 890 JSR window1
 900 JSR catdisc
 910 JSR window2
 920 LDA #deletemess MOD 256
 930 STA&F8
 940 LDA #deletemess DIV 256
 950 STA&F9
 960 JSR print
 970 .checkey
 980 LDX #0:LDA #21
 990 JSR osbyte
1000 JSR osrdch
1010 .checkesc
1020 CMP #27:BEQ menurentry
1030 CMP #"1":BEQ deletecsd
1040 CMP #"2":BEQ dirchange
1050 CMP #"3":BEQ accesschang
e
1060 JMP checkey
1070 :
1080 .dirchange
1090 JMP changedir
1100 :
1110 .accesschange
1120 JMP changeaccess
1130 :
1140 .deletecsd
1150 JSR window3
1160 LDA #deleteornot MOD 256
1170 STA &F8
1180 LDA #deleteornot DIV 256
1190 STA &F9
1200 JSR print
1210 JSR window4
1220 LDY #1:JSR cursoron
1230 JMP destroy
1240 :
1250 .compact
1260 JSR window1
1270 JSR mapfree
1280 JSR window2
1290 LDA #compacting MOD 256
1300 STA &F8
1310 LDA #compacting DIV 256
1320 STA &F9
1330 JSR print
1340 .response
1350 JSR osrdch
1360 .checkesc
1370 CMP #27:BEQ no
1380 AND #&DF
1390 CMP #ASC"Y":BEQ go
1400 CMP #ASC"N":BEQ no
1410 JMP response
1420 .no:JMP menurentry
1430 .go:JSR oswrch
1440 .docompact
1450 JSR window1
1460 LDX #discompact MOD 256
1470 LDY #discompact DIV 256
1480 JSR oscli
1490 JSR window1
1500 JSR mapfree
1510 JSR window3
1520 LDA #done MOD 256
1530 STA &F8
1540 LDA #done DIV 256
1550 STA &F9
1560 JSR print
1570 JMP getescape
1580 .discompact
1590 EQUS"COM. 1D 3B"+CHR$13
1600 :
1610 .print
1620 LDY #&FF
1630 .nextchr
1640 INY
1650 LDA (&F8),Y:CMP #&FF
1660 BEQ out:JSR oswrch
1670 JMP nextchr
1680 .out:RTS
1690 :
1700 .window0
1710 LDA #data0 MOD 256:STA &F8
1720 LDA #data0 DIV 256:STA &F9
1730 JMP setwindow
1740 :
1750 .window1
1760 LDA #data1 MOD 256:STA &F8
1770 LDA #data1 DIV 256:STA &F9
1780 JMP setwindow
1790 :
1800 .window2
1810 LDA #data2 MOD 256:STA &F8
1820 LDA #data2 DIV 256:STA &F9
1830 JMP setwindow
1840 :
1850 .window3
1860 LDA #data3 MOD 256:STA &F8
1870 LDA #data3 DIV 256:STA &F9
1880 JMP setwindow
1890 :
1900 .window4
1910 LDA #data4 MOD 256:STA &F8
1920 LDA #data4 DIV 256:STA &F9
1930 .setwindow:JSR print:RTS
1940 :
1950 .data0
1960 EQUB 28:EQUB 0:EQUB 30
1970 EQUB 39:EQUB 4:EQUB 12
1980 EQUB &FF
1990 :
2000 .data1
2010 EQUB 28:EQUB 0:EQUB 22
2020 EQUB 39:EQUB 4:EQUB 12
2030 EQUB &FF
2040 :
2050 .data2
2060 EQUB 28:EQUB 0:EQUB 30
2070 EQUB 39:EQUB 23:EQUB 12
2080 EQUB &FF
2090 :
2100 .data3
2110 EQUB 28:EQUB 0:EQUB 30
2120 EQUB 39:EQUB 26:EQUB 12
2130 EQUB &FF
2140 :
2150 .data4
2160 EQUB 28:EQUB 17:EQUB 28
2170 EQUB 39:EQUB 27:EQUB 12
2180 EQUB 10:EQUB &FF
2190 :
2200 .cursoroff
2210 .cursoron
2220 LDA #23:JSR oswrch
2230 LDA #1:JSR oswrch
2240 TYA:JSR oswrch
2250 LDX #6:LDA #0
2260 .set:JSR oswrch
2270 DEX:BPL set
2280 RTS
2290 :
2300 .mountdisc
2310 LDX #discmount MOD 256
2320 LDY #discmount DIV 256
2330 JSR oscli:RTS
2340 .discmount
2350 EQUS"MOU."+CHR$13
2360 :
2370 .catdisc
2380 LDX #discat MOD 256
2390 LDY #discat DIV 256
2400 JSR oscli:RTS
2410 .discat
2420 EQUS"."+CHR$13
2430 :
2440 .mapfree
2450 LDX #discmap MOD 256
2460 LDY #discmap DIV 256
2470 JSR oscli:JSR osnewl
2480 LDX #discfree MOD 256
2490 LDY #discfree DIV 256
2500 JSR oscli:RTS
2510 .discmap
2520 EQUS"MAP"+CHR$13
2530 .discfree
2540 EQUS"FREE"+CHR$13
2550 :
2560 .changedir
2570 JSR window3
2580 LDA #dirmess MOD 256
2590 STA &F8
2600 LDA #dirmess DIV 256
2610 STA &F9
2620 JSR print
2630 JSR getfilename
2640 LDY #3
2650 .storecommand1
2660 LDA dircommand,Y
2670 STA commandstring,Y
2680 DEY:BPL storecommand1
2690 JSR execute
2700 JMP deletefiles
2710 .dircommand
2720 EQUS"DIR "
2730 :
2740 .execute
2750 LDX #commandstring
```



```
2760 LDY #0
2770 JSR oscli:RTS
2780 :
2790 .changeaccess
2800 JSR window3
2810 LDA #accessmess MOD 256
2820 STA &F8
2830 LDA #accessmess DIV 256
2840 STA &F9
2850 JSR print
2860 JSR getfilename
2870 LDY #3
2880 .storecommand2
2890 LDA accesscomm,Y
2900 STA commandstring,Y
2910 DEY:BPL storecommand2
2920 JSR execute
2930 JMP deletefiles
2940 .accesscomm
2950 EQUS"ACC."
2960 :
2970 .erroroutine
2980 .resetstack
2990 LDX #&FF:TXS
3000 JSR window2
3010 LDY #0:JSR cursoroff
3020 LDA #errormessage MOD 256
3030 STA &F8
3040 LDA #errormessage DIV 256
3050 STA &F9
3060 JSR print
3070 .printerror
3080 LDY #1
3090 .error
3100 LDA (&FD),Y:BEQ getescape
3110 JSR oswrch
3120 INY:JMP error
3130 .getescape
3140 JSR osrdch
3150 CMP #27:BNE getescape
3160 JMP menurentry
3170 :
3180 .destroy
3190 .zerobuffers
3200 LDX #34:LDA #0
3210 .flush:STA &70,X
3220 DEX:BPL flush
3230 .mainloop
3240 .savefilecounter
3250 LDA block+9:STA temp
3260 LDA block+10:STA temp+1
3270 .setparamblk
3280 LDA #commandstring+3
3290 STA block+1
3300 LDA #0:STA block+2
3310 LDA #1:STA block+5
3320 .readirectory
3330 LDX #block:LDY #0
3340 LDA #8:JSR osgbpb
3350 .checkforfiles
3360 LDA #1:CMP block+5
3370 BNE delete
3380 .nomoresoend
3390 JMP deletefiles
3400 .delete:LDY #1
3410 .printfilename
3420 LDA commandstring+3,Y
3430 JSR oswrch
3440 INY:DEC commandstring+3
3450 BNE printfilename
3460 LDA #ASC":":JSR oswrch
3470 .setret
3480 LDA #13
3490 STA commandstring+3,Y
3500 LDY #3
3510 .setdel
3520 LDA delcommand,Y
3530 STA commandstring,Y
3540 DEY:BPL setdel
3550 .getYN
3560 JSR osrdch
3570 .checkesc
3580 CMP #27:BEQ esc
3590 AND #&DF
3600 CMP #ASC"Y":BEQ godelete
3610 CMP #ASC"N":BEQ not
3620 JMP getYN
3630 .godelete
3640 LDA #ASC"Y":JSR oswrch
3650 JSR execute
3660 .restorefilecounter
3670 LDA temp:STA block+9
3680 LDA temp+1:STA block+10
3690 JMP repeat
3700 .not
3710 LDA #ASC"N":JSR oswrch
3720 .repeat
3730 JSR osnewl:JMP mainloop
3740 .esc
3750 JMP menurentry
3760 .delcommand
3770 EQUS"DEL."
3780 :
3790 .getfilename
3800 LDY #1:JSR cursoron
3810 LDX #0
3820 .getinput
3830 JSR osrdch
3840 .checkesc
3850 CMP #27:BEQ esc
3860 CMP #13
3870 BNE checkdelete
3880 .returnpressed
3890 STA commandstring+4,X
3900 .endroutine:RTS
3910 .checkdelete
3920 CMP #127:BNE checkchar
3930 .deletepressed
3940 CPX #0:BEQ outofrange
3950 .delonscreen:JSR oswrch
3960 DEX:JMP getinput
3970 .checkchar
3980 CPX #14:BEQ outofrange
3990 CMP #32:BCC outofrange
4000 CMP #127:BCC validchr
4010 .outofrange
4020 .beep:LDA #7:JSR oswrch
4030 JMP getinput
4040 .validchr
4050 .printoscreen:JSR oswrch
4060 .saveinbuffer
4070 STA commandstring+4,X
4080 INX:JMP getinput
4090 :
4100 .title
4110 EQUB 31:EQUB 12:EQUB 0
4120 EQUS"DISC HOUSEKEEPER"
4130 EQUB 31:EQUB 12:EQUB 1
4140 EQUS"~~~~ ~~~~~~~~~~"
4150 EQUB 31:EQUB 13:EQUB 31
4160 EQUS"ESCAPE for Menu"
4170 EQUB &FF
4180 :
4190 .newdiscmess
4200 EQUB 31:EQUB 6:EQUB 14
4210 EQUS"INSERT DISC and PRESS
RETURN"
4220 EQUB &FF
4230 :
4240 .menu
4250 EQUB 31:EQUB 18:EQUB 5
4260 EQUS"MENU"
4270 EQUB 31:EQUB 13:EQUB 10
4280 EQUS"1...New DISC"
4290 EQUB 31:EQUB 13:EQUB 12
4300 EQUS"2...Delete Files"
4310 EQUB 31:EQUB 13:EQUB 14
4320 EQUS"3...Compact Disc"
4330 EQUB &FF
4340 :
4350 .deletemess
4360 EQUB 31:EQUB 14:EQUB 1
4370 EQUS"DELETE FILES"
4380 EQUB 31:EQUB 1:EQUB 4
4390 EQUS"1...Delete from CSD
 2...Change DIR"
4400 EQUB 31:EQUB 12:EQUB 6
4410 EQUS"3...Change ACCESS"
4420 EQUB &FF
4430 :
4440 .deleteornot
4450 EQUB 31:EQUB 5:EQUB 2
4460 EQUS"Delete Y/N?"
4470 EQUB &FF
4480 :
4490 .compacting
4500 EQUB 31:EQUB 15:EQUB 1
4510 EQUS"COMPACTING"
4520 EQUB 31:EQUB 16:EQUB 4
4530 EQUS"GO Y/N? "
4540 EQUB &FF
4550 :
4560 .done
4570 EQUB 31:EQUB 18:EQUB 1
4580 EQUS"Done"
4590 EQUB 7
4600 EQUB &FF
4610 :
4620 .dirmess
4630 EQUB 31:EQUB 4:EQUB 1
4640 EQUS"*DIR "
4650 EQUB &FF
4660 :
4670 .accessmess
4680 EQUB 31:EQUB 4:EQUB 1
4690 EQUS"*ACCESS "
4700 EQUB &FF
4710 .errormessage
4720 EQUB 31:EQUB 0:EQUB 3
4730 EQUS"ERROR: "
4740 EQUB 7
4750 EQUB &FF
4760 ]:NEXT
4770 :
4780 comm$="SAVE HK 880 "+STR$~P
X
4790 OSCLI comm$
```

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Here's how you can get the very best out of your Electron

Within the pages of these three books you'll find ALL the information you need to fully harness the power of your Electron. They cover Basic, machine-code programming and the operating system, and between them they also show how to combine all three to create more powerful and effective programs.

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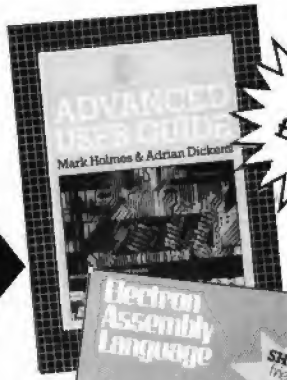

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This detailed guide to the Electron's operating system is packed full of invaluable information. It shows you how to:

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- Write your own paged roms
- Program the ULA
- Make every byte count where program space is tight
- Use the Electron's exciting capabilities to the full by following the complete circuit diagram

. . .and much, much more.

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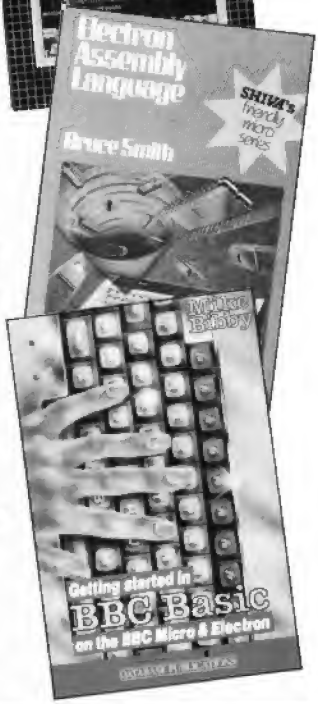

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The Electron Assembly Language reference guide will help you get to grips with machine code in next to no time. Whether you're a beginner or are already fairly proficient, there is something for you in this book.

It has over 200 pages packed with hints, tips and example programs on subjects ranging from basic hex, binary and decimal number theory and logical operators, through addressing modes, stacks and loops, to subroutines, jumps and calls.

Every aspect of machine-code programming is covered in this book in a friendly, readable style, and there's also a comprehensive index. If you want to get more out of your micro, but thought machine code was indecipherable, this is the book for you. *Save £3 off the recommended retail price.*

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The elementary Electron

Francis Botto takes off your micro's casing and explains how all the components function

If you treat your Electron as the proverbial black box and disregard its inner workings you probably have about as much proof of the existence of computer hardware within its casing as historians have of the Arthurian legend.

The Electron is most frequently referred to as having 32k of ram and a 6502 8 bit processor. There is a lot more to its hardware than is contained in that concise sentence, so what does it mean?

Beginning with the memory, ram is an acronym for random access memory. It is, comically, a misnomer that has plagued and confused newcomers to hardware for a long time.

It was originally thought up because each piece of data in a typical memory device took an equal amount of time to access. However, it was later realised that a rom, or read only memory device, could be described as ram too.

All you have to remember is this: You can read and write data to and from ram while you can only read data from rom, as its name clearly suggests. As such, programs in rom are usually unalterable. In this form, roms are sometimes referred to as firmware packages.

The Electron's operating system itself is stored in such a package as is the Basic interpreter.

For the record, there are numerous types of rom including prom (programmable read only memory) and eprom (erasable programmable read only memory). These can be programmed and then erased by shining ultra violet light on to the chip via a transparent window.

Finally, there is the eeprom (electrically erasable programmable read only memory) which can be erased by passing a small electric current through it.

Dram (dynamic random access memory) and sram (static random access memory) represent two types of ram. Dram has to be constantly "refreshed" by revitalising charges from capacitors which are used to retain the state of each individual memory cell. Like all ram, dram is said to be volatile in that when the computer is switched off all memory contents are lost.

Sram does not require constant refreshing, so it relies on less sophisticated electronics. However, it consumes more power, is slower and less compact – three reasons why dram is the more popular of the two.

Outside the world of the Electron the best known dram device is the 256k chip. Extreme fluctuations in their price caused turmoil in the computer industry in recent years with many computer manufacturer's designing and redesigning computers according to the unit price. The price of 256k dram chips has almost been like a high risk share.

When anyone mentions memory capacity the letter k is bandied about like there's no tomorrow. It is a measure of bytes. And what's a byte? It is simply eight binary bits of information, like this: 10011101.

The letter k is really short for kilobyte and is often regarded as 1,000 bytes. In actual fact it is slightly more – a k is 1,024 bytes of memory.

Where does that odd 1,024 figure come from? It stems from the number of address lines in an array of memory. For example, suppose you had a memory device which had an address bus made up of 10 lines, as shown in Figure 1.

The address lines on a memory device determine how many memory locations it can support. For instance, the device shown will support two to the power 10, which is 2x2x2x2x2x2x2x2x2x2, and if you work that out you will find it equals 1,024. So conveniently, it was decided that this would be a k.

Microprocessors represent another microelectronics device which is mentioned whenever reference is made to a machine. For instance, you hear people say 6502-based, 6502 CPU or 6502 processor. CPU stands for central processing unit.

The CPU itself is made up of several elements such as ALU (arithmetic logic unit) which performs all arithmetic and logic operations, and numerous registers which are small slices of memory containing eight bits of data – a byte.

The program counter – another register found in the microprocessor – is made up of two 8 bit registers. Since it points to loca-

Turn to Page 22 ▶

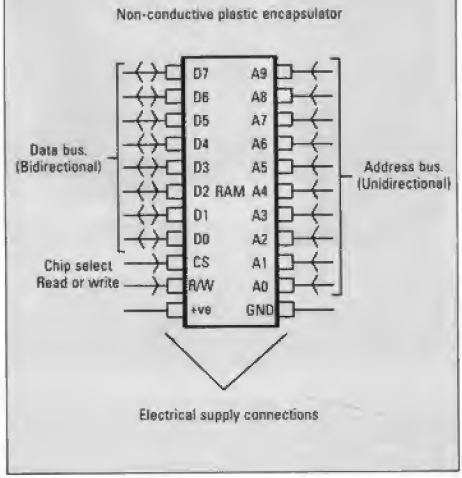

Figure 1: Address bus of a typical microprocessor

◀ From Page 21

tions in the Electron's memory, it has to be able to count up to 32k. This is a 16 bit number, thus requires two bytes.

The 6502 is said to be 8 bit. Lots of machines and microprocessors are referred to in this manner. In simple terms it refers to the size of pieces of data which can be manipulated in a single operation.

If you look at a microprocessor like that shown in Figure II for instance, you can determine whether it is 8 bit, 16 or 32 bit by counting the data lines. Of course, the various lines are not marked on real devices, so you will need an accompanying manufacturer's data sheet to determine which line does what.

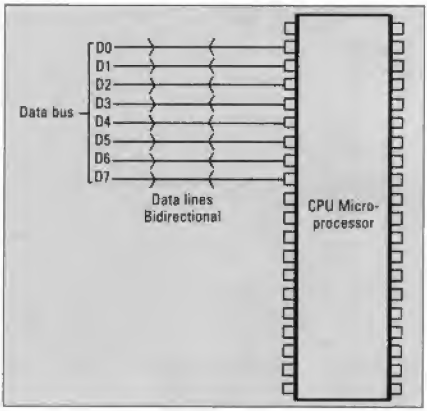

Figure II: Counting the data lines of a microprocessor will tell you whether it is an 8, 16 or 32 bit device

The data lines making up the data bus affect the speed of the microprocessor. Generally speaking, the more there are the faster it is.

So far we have looked at the fundamentals of the Electron's design, but there is a great deal more to it. For instance, there is the whole matter of driving monitors, controlling disc drives, transmitting and receiving data to and from cassette recorders and so forth.

An interesting feature of the hardware is the inclusion of an uncommitted logic gate array. If you were to take the lid off your micro you would find this device staring you in the face. The ULA is a large square chip directly above the copyright symbol.

This is not an off-the-shelf device that you can buy from any electronics outlet, but specifically designed for the Electron. The ULA starts life as a collection of electronic logic gates. It is then left to designers to commit, or connect, the gates so as to satisfy a particular design.

A ULA could therefore be described as a kind of blank chip which can be aimed at a number of applications. The Electron's is used to handle the video and sound controller as well as cassette input and output (I/O) and various other I/O operations.

This is by no means the end of the story, but armed with this information you should be able to tackle some of the more advanced hardware manuals.

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How to apply the big squeeze

Cram more graphics on to disc with this handy utility from Roland Waddilove

THE Electron is a very reliable performer when it comes to saving and loading files from floppy disc. However, disc space is rather limited, particularly when you want to save several Mode 2 graphics screens to a 40 track DFS disc. You can just about squeeze five screens into the 100k of storage space. The ADFS is slightly better in having three times the storage capacity, but there's still only room for 15 pictures.

In my Sprites series of articles running from the February to July 1988 issue of *Electron User* I showed how graphics screens in arcade games can take up as little as eight bytes. This is fine for games made up of sprites, but it doesn't help the artist drawing freehand in Mode 2. How can we squash these massive 20k screens?

Many compaction methods are available to the programmer and the one chosen largely depends on the particular screen being treated. The simplest method is the byte and counter method.

If you look closely at most Mode 2 graphics screens you'll notice that there are often large areas of solid colour, and looking at the bytes making up the screen memory, you'll see large areas where they are all the same.

What we could do is to start scanning through the screen memory looking for these areas. Get a byte, count how many identical ones follow it, store the byte and counter. Get the next – different – byte, count how many identical ones there are, store the byte and counter. And so on.

In this way, the following section of screen memory:

```
10,10,10,10,28,28,28,91,91...
```

would be stored as:

```
10,4,28,3,91,2...
```

In this case nine bytes have been compacted into six – two thirds the space. Quite a significant saving. The major drawback is that the method only works for simple screens. Take the case where every byte is different to its neighbour. The byte will be stored along with a counter value of one:

```
10,57,34,86,98...
```

becomes:

```
10,1,57,1,34,1,86,1,98,1...
```

You can see that twice as much space is taken up – the exact opposite of what is wanted. Somehow the technique must be improved.

Now the Electron's screen memory is laid out in a peculiar manner, and if each of the eight colours numbered zero to seven is displayed you'll see that each screen byte has a value less than 128. In other words, bit seven is never used.

We can use this as a flag to indicate whether the following byte is the same or different as the current one. The same byte and counter method can still be used, but with the additional condition that if bit seven is set there is a following count byte, and if it's clear there isn't a counter and the byte is simply stored in the screen.

So bit seven becomes a flag to show whether the current byte is repeated more than once. If it is, the following byte is a counter. Taking the worst possible case where every screen byte is different to its neighbours, the screen will not be compacted and will be exactly the same size as before.

However, as soon as a run of identical bytes is found the compaction routine starts to operate and the screen is crunched into a smaller space. All this is assuming, as mentioned earlier, that only colours zero to seven are used.

Program I will draw and save a moderately complicated Mode 2 screen and you can see the compaction routine in action by running Program II. The degree of compaction depends on the complexity of the display. A 20k screen can be squeezed into as little as 2k. Compare the file sizes of the original and compacted screens and see for yourself.

To prove that the compaction routine really does work, Program III will expand the crunched screen and display it as it originally appeared. With the aid of this utility you can now store up to 50 screens on a DFS disc and around 150 on an ADFS disc – quite an improvement!

```
10 REM Program I
20 REM Draw triangles
30 MODE 2
40 FOR I=1 TO 10
50 GCOL 3,RND(7)
60 MOVE RND(1280),RND(1024)
70 MOVE RND(1280),RND(1024)
80 PLOT 85,RND(1280),RND(1024)
90 NEXT
100 *SAVE SCREEN 3000 8000
```

```
 10 REM Program II
 20 REM Compact screen
 30 REM Bit 7 = multiple bytes
 40 ON ERROR CLOSE#0:REPORT:PRI
NT" at line ";ERL:END
 50
 60 MODE 2 : *FX16
 70 *LOAD SCREEN 3000
 80 PROCsave("SCR1")
 90 END
100
110 DEF PROCsave(fname$)
120 F%=OPENOUT fname$
130 A%=&3000
140 REPEAT
150 IF ?A%=A%?1 PROCcount ELSE
BPUT#F%,?A% : A%=A%+1
160 UNTIL A%>&8000
170 CLOSE#F%
180 ENDPROC
190
200 DEF PROCcount
210 P%=A%
220 REPEAT
230 P%=P%+1
240 UNTIL ?P%<>?A% OR P%-A%=255
250 B%=?A% OR 128
260 C%=P%-A%
270 A%=P%
280 BPUT#F%,B% : BPUT#F%,C%
290 ENDPROC
```

```
 10 REM Program III
 20 REM Expand screen
 30 REM Bit 7 = multiple bytes
 40 ON ERROR CLOSE#0:REPORT:PRI
NT" at line ";ERL:END
 50
 60 MODE 2 : *FX16
 70 PROCload("SCR1")
 80 END
 90
100 DEF PROCload(fname$)
110 F%=OPENIN fname$
120 A%=&3000
130 REPEAT
140 B%=BGET#F%
150 IF B% AND 128 PROCmulti ELS
E ?A%=B% : A%=A%+1
160 UNTIL A%>&8000
170 CLOSE#F%
180 ENDPROC
190
200 DEF PROCmulti
210 B%=B% AND 127
220 C%=BGET#F%
230 REPEAT
240 ?A%=B% : A%=A%+1 : C%=C%-1
250 UNTIL C%=0
260 ENDPROC
```

It's Electron micro analysis

Julie Boswell puts on her white coat and presents two advanced programs for testing your knowledge and understanding of chemical procedures

IF you are struggling with your chemistry A level here are two educational utilities to help you brush up on some of the more complicated, but essential, calculations required in both the laboratory and chemistry theory.

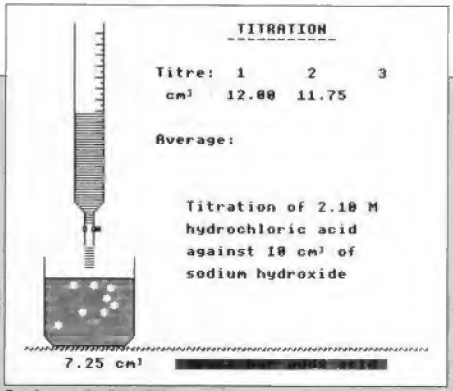
The first program, Titration, is a computer simulation of the acid/base titration procedure normally carried out in the laboratory to produce a salt. A burette of acid and beaker of alkali are drawn on the screen. Add acid to the alkali by pressing the spacebar. Stop when the alkali changes colour indicating that it has been neutralised.

The first titration is performed simply to get a rough estimate of the amount of acid required. The second and third should be done more accurately – adding acid quickly at first, then slowing down near the end point.

Once this has been done the Electron will calculate the average titre and demonstrate, step by step how to calculate the strength of the alkali, given that of the acid. On subsequent titrations you'll be asked to work this out yourself. If you make a mistake the micro will again demonstrate the calculation.

The second program will test your ability to balance chemical equations. An incomplete equation – for instance a reaction of a metal with water – will be displayed on the screen. Using only the numeric keys you must balance the equation so that there are an equal number of atoms on both sides.

An example is demonstrated on the instruction screen. You can have two attempts, and if you still get it wrong the Electron will provide the correct answer.



Practise your titration technique

```
   10 REM Titration
   20 REM By Julie Boswell
   30 REM (c) Electron User
   40 IF PAGE>&E00 PROCrelocate
   50 MODE 1
   60 PROCinitialise
   70 PROCinstructions
   80 REPEAT
   90 PROCtitles
  100 PROCdraw_burette
  110 PROCdraw_beaker
  120 PROCfill_beaker
  130 FOR titre=1 TO 3
  140 PROCstart
  150 PROCtitrate
  160 NEXT
  170 PROCfinished
  180 PROCcalculation
  190 PROCanother
  200 UNTIL INSTR("Ee",key$)
  210 MODE 6
  220 *FX4,0
  230 *FX12,0
  240 END
  250
  260 DEF PROCstart
  270 VDU 19,1,1;0;:PROCfill_bure
tte
  280 cc=0:PRINT TAB(4,31);cc;" c
m³";CHR$236;
  290 ENDPROC
  300
  310 DEF PROCinitialise
  320 *KEY10,"OLD¦MRUNM"
  330 *FX11,0
  340 *FX4,1
  350 PROCcharacters:DIM vol(3)
  360 @%=&20207:titrations=0
  370 ENDPROC
  380
  390 DEF PROCcharacters
  400 REM ** burette **
  410 VDU 23,224,128,128,128,128,
128,128,128,128
  420 VDU 23,225,1,1,1,7,1,1,1,12
7
  430 VDU 23,226,128,64,32,16,8,4
,2,1
  440 VDU 23,227,1,2,4,8,16,32,64
,128
  450 VDU 23,228,129,129,129,129,
129,129,129,129
  460 VDU 23,229,0,0,1,1,1,1,0,0
  470 VDU 23,230,129,129,255,0,0,
255,129,129
  480 VDU 23,231,24,24,216,248,24
8,216,24,24
  490 VDU 23,232,129,129,231,0,0,
231,129,129
  500 VDU 23,233,0,0,216,248,248,
216,0,0
  510 VDU 23,234,1,1,1,1,1,1,1,12
7
  520 REM ** beaker **
  530 VDU 23,235,1,1,1,1,1,1,1,1
  540 REM ** 3 **
  550 VDU 23,236,56,8,24,8,56,0,0
,0
  560 REM * top *
  570 VDU 23,237,129,129,195,66,6
6,195,129,129
  580 REM * acid **
  590 VDU 23,238,0,255,0,255,0,25
5,0,255
  600 VDU 23,239,0,24,24,0,0,102,
102,0
  610 ENDPROC
  620
  630 DEF PROCdraw_burette
  640 GCOL 0,12B:GCOL 0,3
  650 VDU 31,5,1,224,32,234
  660 FOR i%=2 TO 16
  670 VDU 31,5,i%,224,32,225,32
  680 NEXT
  690 VDU 31,5,17,226,32,227,31,6
,18,228
  700 VDU 31,5,19,229,230,231,31,
6,20,228
  710 ENDPROC
  720
  730 DEF PROCdraw_beaker
  740 FOR i%=22 TO 28
  750 PRINT TAB(2,i%);CHR$224;"
    ";CHR$235;
  760 NEXT
  770 PRINT'"  ";CHR$226;"_______
";CHR$227'STRING$(40,"~");
  780 ENDPROC
  790
  800 DEF PROCfill_burette
  810 GCOL 0,2:GCOL 0,128
  820 FOR i%=411 TO 967 STEP 8
  830 PLOT 77,207,i%
  840 NEXT
  850 ENDPROC
  860
  870 DEF PROCfill_beaker
  880 GCOL 0,1
  890 FOR i%=67 TO 255 STEP 4
  900 PLOT 77,127,i%
  910 NEXT
  920 GCOL 0,3
  930 MOVE 67,259:DRAW 351,259
  940 ENDPROC
  950
  960 DEF PROCtitrate
  970 titrations=titrations+1
  980 REPEAT
  990 IF INKEY-99 PROCadd_acid
 1000 UNTIL cc>=end
 1010 vol(titre)=cc
 1020 PRINT TAB(13+titre*7,7);cc
 1030 SOUND 1,-10,50,5
 1040 PROCpause(200)
 1050 ENDPROC
 1060
```

```
Average Titre=10.75 cm³      Acid=2.70 M

1000 cm³ acid will contain 2.70 moles
1 cm³ acid will contain 2.70/1000 moles
10.75 cm³ contain 10.75x2.70/1000 moles

10.75x2.70/1000 moles must also be the
number of moles of alkali in the 10 cm³
in the beaker.

1000cm³ contains 100x10.75x2.70/1000 mol
.. the alkali is 100x10.75x2.70/1000 M

Alkali=2.90 M

Press the space bar...
```

Calculating the strength of an alkali

```
Reaction Of Metals With Water

        2Na + 2H₂O ⟶ 2NaOH + H₂

Q1. Try to balance the equation.

The first number is...
The second number is...
The third number is...
The fourth number is...

Hurray, you got it right.
```

Balance the chemical equation

```
 1070 DEF PROCadd_acid
 1080 PRINT TAB(6,19);CHR$237;CHR
$233
 1090 VDU 17,2,31,6,21,238,8,10,2
38
 1100 COLOUR 3:GCOL 0,130:GCOL 0,
0
 1110 REPEAT TIME=0
 1120 VDU5:MOVE 92+RND(192),255-R
ND(128):VDU42,4:PLOT 77,207,963-3
2*cc
 1130 cc=cc+.25:PRINT TAB(4,31);c
c;
 1140 IF cc=end VDU 19,1,0;0;
 1150 REPEAT UNTIL TIME>20
 1160 UNTIL NOT INKEY-99 OR cc=16
 1170 PRINT TAB(6,19);CHR$230;CHR
$231
 1180 VDU 17,1,31,6,22,32,8,11,32
,17,3
 1190 COLOUR 129
 1200 FOR i%=28 TO 24 STEP -1
 1210 TIME=0
 1220 PRINT TAB(2,i%);CHR$224;"
    ";CHR$235
 1230 REPEAT UNTIL TIME>20-end+cc
 1240 NEXT
 1250 COLOUR 128
 1260 ENDPROC
 1270
 1280 DEF PROCtitles
 1290 VDU 19,1,1;0;19,2,4;0;23,1,
0;0;0;0;
 1300 PRINT TAB(21,1);"TITRATION"
;TAB(20,2);"-----------";TAB(13,5
);"Titre:  1       2       3";TAB(1
4,7);"cm";CHR$236;TAB(13,11);"Ave
rage:"
 1310 COLOUR 130:PRINT TAB(15,31)
;" space bar adds acid ";:COLOUR
128
 1320 end=2+RND(48)/4
 1330 Macid=RND(50)/10
 1340 PROCpick_reagents
 1350 PRINT TAB(16,17);"Titration
 of ";Macid;" M";TAB(16,19);acid$
;" acid";TAB(16,21);"against 10 c
m";CHR$236;" of";TAB(16,23);alkal
i$
 1360 ENDPROC
 1370
 1380 DEF PROCpick_reagents
 1390 RESTORE 1490
 1400 FOR i%=1 TO RND(3)
 1410 READ acid$
 1420 NEXT
 1430 RESTORE 1500
 1440 FOR i%=1 TO RND(3)
 1450 READ alkali$
 1460 NEXT
 1470 ENDPROC
 1480
 1490 DATA hydrochloric,nitric,ac
etic
 1500 DATA sodium hydroxide,potas
sium hydroxide,ammonia solution
 1510
 1520 DEF PROCfinished
 1530 PRINT TAB(15,31);SPC(21);
 1540 average=(vol(2)+vol(3))/2
 1550 PRINT TAB(21,11);average;"
cm";CHR$236
 1560 SOUND 1,-10,0,5
 1570 COLOUR 130:PRINT TAB(16,27)
;" Titration finished ";TAB(18,31
);" press space bar ";
 1580 *FX21,0
 1590 REPEAT
 1600 UNTIL GET=32
 1610 ENDPROC
 1620
 1630 DEF PROCcalculation
 1640 COLOUR 128 : CLS
 1650 VDU 19,1,2;0;19,2,3;0;23,1,
1;0;0;0;
 1660 PRINT''"Average Titre=";ave
rage;" cm";CHR$236;TAB(28);"Acid=
";Macid;" M"
 1670 COLOUR 2:answer=TRUE
 1680 IF titrations=3 PROCwork_ou
t ELSE PROCinput
 1690 IF NOT answer PROCwork_out
 1700 IF end<average PROCerror
 1710 ENDPROC
 1720
 1730 DEF PROCwork_out
 1740 PRINT TAB(0,5);"1000 cm";CH
R$236;" acid will contain ";Macid
;" moles"
 1750 PRINT'"1 cm";CHR$236;" acid
```

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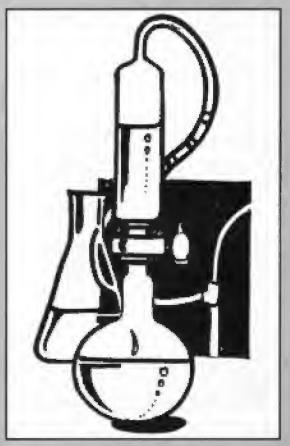
◀ From Page 25

```
 will contain ";Macid;"/1000 mole
s"
 1760 PRINT';average;" cm";CHR$23
6;" contain ";average;"x";Macid;"
/1000 moles"
 1770 COLOUR 1:PRINT''';average;"
x";Macid;"/1000 moles must also b
e the"''"number of moles of alkal
i in the 10 cm";CHR$236''"in the
beaker."
 1780 PRINT''"1000cm";CHR$236;" c
ontains 100x";average;"x";Macid;"
/1000 mol"
 1790 COLOUR 129:COLOUR 3:PRINT'"
 ";CHR$239;" the alkali is 100x";
average;"x";Macid;"/1000 M "
 1800 COLOUR 128:PRINT''"Alkali="
;average*Macid/10;" M"
 1810 PRINT''"Press the space bar
..."
 1820 VDU 7
 1830 REPEAT
 1840 UNTIL GET=32
 1850 CLS
 1860 ENDPROC
 1870
 1880 DEF PROCinput
 1890 REPEAT
 1900 INPUT TAB(0,5);"What is the
molarity of the alkali"''"in the
beaker ";alkali$
 1910 UNTIL LEN alkali$
 1920 IF ABS(average*Macid/10)-E
VAL alkali$)>0.01 answer=FALSE
 1930 PRINT'"Your calculation is
";
 1940 IF answer PRINT "correct."
ELSE PRINT "wrong...":SOUND 1,-15
,0,20:PROCpause(500)
 1950 COLOUR 3
 1960 ENDPROC
 1970
 1980 DEF PROCerror
 1990 VDU 19,1,6;0;
 2000 PRINT''"Your titration have
ver was inaccurate,"''"you added
too much acid too quickly"''"and
missed the end point. The alkali"
''"was actually ";end*Macid/10;"
M not ";average*Macid/10;" M."
 2010 COLOUR 2:PRINT''"The indica
tor changed at ";end;" cm";CHR$23
6''"your average titration was ";
average;" cm";CHR$236
 2020 COLOUR 1:PRINT''"Try to be
more careful when you add"''"the
acid next time.":COLOUR 3
 2030 VDU 7
 2040 ENDPROC
 2050
 2060 DEF PROCanother
 2070 PRINT''"Press the space ba
r to try another"''"titration or
E to end the program...";
 2080 *FX21,0
 2090 REPEAT
 2100 key$=GET$
 2110 UNTIL INSTR("Ee ",key$)
 2120 CLS
 2130 ENDPROC
 2140
 2150 DEF PROCinstructions
 2160 VDU 12,19,1,6;0;
 2170 PRINT'TAB(14);"TITRATION"
 2180 COLOUR 2:PRINT'"Three titra
tions are carried out, the"''"1st
 is a rough one then 2 accurate o
nes."''"The average of the 2nd and
 3rd is found."
 2190 COLOUR 1:PRINT'"The molarit
y of the alkali must be"''"calcul
ated given the molarity of the"''
"acid, ( by the computer the firs
t time,"''"then by you after that
 )."
 2200 COLOUR 2:PRINT''"The acids
and alkalis used have been"''"cho
sen to make the calculation as as
sy"''"as possible. The number of m
oles of acid"''"needed to neutral
ise the alkali is the"''"same as
the number of moles of alkali."
 2210 COLOUR 3:PRINT''"Press the
space bar to start...";:VDU 7
 2220 REPEAT
 2230 UNTIL GET=32
 2240 CLS
 2250 ENDPROC
 2260
 2270 DEF PROCpause(time%)
 2280 TIME=0
 2290 REPEAT
 2300 UNTIL TIME>time%
 2310 ENDPROC
 2320
 2330 DEF PROCrelocate
 2340 *FX200,2
 2350 *KEY9 "OLD|MRUN|M"
 2360 *TAPE
 2370 DX=PAGE-&E00:FOR I%=PAGE TO
TOP STEP4:!(I%-DX)=!I%:NEXT:?(TO
P-0%)=255:PAGE=&E00:*FX21,0
 2380 *FX138,0,137
 2390 END
```

Balancing act

```
  10 REM ** EQUATION **
  20 REM By Julie Boswell
  30 REM (c) Electron User
  40 IF PAGE>&E00 PROCrelocate:E
ND
  50 MODE 1
  60 PROCinitialise
  70 PROCinstructions
  80 REPEAT
  90 PROCstart
 100 FOR QX=1 TO 10
 110 PROCget_data
 120 PROCprint_equation
 130 PROCinput_answer
 140 NEXT
 150 PROCscores
 160 UNTIL INSTR("Nn",key$)
 170 MODE 6 :*FX4,0
 180 *FX12,0
 190 *FX220,27
 200 END
 210
 220 DEF PROCstart
 230 score=0
 240 VDU19,1,1;0;19,2,3;0;19,3,7
;0;
 250 VDU23,1,0;0;0;0;
 260 ENDPROC
 270
 280 DEF PROCinitialise
 290 *FX11,0
 300 *FX220,64
 310 ENVELOPE 1,1,1,4,8,4,4,20,1
26,0,0,-126,126,126
 320 ENVELOPE 2,128,-1,-2,-4,5,1
0,20,126,0,0,-126,126,126
 330 PROCcharacters:*FX4,1
 340 equation$=STRING$(40,"=")
 350 DIM number(6),answer(6)
 360 ENDPROC
 370
 380 DEF PROCcharacters
 390 REM ** arrow **
 400 VDU 23,225,0,0,0,255,0,0,0,
0
 410 VDU 23,226,8,4,2,255,2,4,8,
0
 420 REM ** double arrow **
 430 VDU 23,227,0,0,255,0,255,64
,32,0
 440 VDU 23,228,4,2,255,0,255,0,
0,0
 450 REM ** numbers **
 460 VDU 23,230,0,0,0,56,40,40,4
0,56
 470 VDU 23,231,0,0,0,16,48,16,1
6,56
 480 VDU 23,232,0,0,0,56,8,56,32
,56
 490 VDU 23,233,0,0,0,56,8,24,8,
56
 500 VDU 23,234,0,0,0,32,32,40,6
0,8
 510 VDU 23,235,0,0,0,56,32,56,8
,56
 520 VDU 23,236,0,0,0,56,32,56,4
0,56
 530 VDU 23,237,0,0,0,56,8,8,8,8
 540 VDU 23,238,0,0,0,56,40,56,4
0,56
 550 VDU 23,239,0,0,0,56,40,56,8
,8
 560 ENDPROC
 570
 580 DEF PROCinput_answer
 590 COLOUR 3:PRINT TAB(0,15);"Q
";QX;". Try to balance the equati
on.":tries=0
 600 REPEAT tries=tries+1
 610 COLOUR 1:PRINT TAB(0,31);"
          <press a number>
   ";
 620 VDU 28,0,30,39,18,12,26
 630 FOR I%=1 TO answer(0)
 640 COLOUR 2:PRINT TAB(0,18+I%+
I%);"The ";
 650 IF I%=1 PRINT "first";
 660 IF I%=2 PRINT "second";
 670 IF I%=3 PRINT "third";
 680 IF I%=4 PRINT "fourth";
 690 IF I%=5 PRINT "fifth";
 700 PRINT " number is...";
 710 VDU 23,1,1;0;0;0;
 720 COLOUR 1:*FX21,0
 730 REPEAT KX=GET-48
 740 UNTIL KX>0 AND KX<10
 750 VDU 23,1,0;0;0;0;7
 760 answer(I%)=KX:PRINT;KX
 770 PROCprint_equation
 780 NEXT
 790 PROCmark_answer
 800 UNTIL correct OR tries=2
 810 PROCpause(500)
 820 COLOUR 3:COLOUR 129:PRINT T
AB(0,15);"            Press the spac
e bar...          ";:COLOUR128:VDU
7
 830 REPEAT
 840 UNTIL GET=32
 850 ENDPROC
 860
 870 DEF PROCmark_answer
 880 correct=TRUE
 890 FOR I%=1 TO answer(0)
 900 IF answer(I%)<>number(I%) c
orrect=FALSE
 910 IF tries=2 answer(I%)=numbe
r(I%)
 920 NEXT
 930 IF tries=2 AND NOT correct
PROCwrong
 940 IF tries=1 AND NOT correct
COLOUR 1:PRINT TAB(0,31);"The equ
ation is not balanced-try again";
:SOUND 1,-15,0,20:PROCpause(500)
 950 IF correct PROCright
 960 ENDPROC
 970
 980 DEF PROCwrong
 990 COLOUR 1:PRINT TAB(0,31);
1000 RX=RND(5)
1010 IF RX=1 PRINT"Oh,No!";
1020 IF RX=2 PRINT"No,No,No";
1030 IF RX=3 PRINT"Dear me";
1040 IF RX=4 PRINT"silly billy";
1050 IF RX=5 PRINT"Aaaahhhh...";
1060 PRINT", wrong again!";STRIN
G$(39-POS," ");
1070 FOR I%=1 TO 50
1080 SOUND 0,-15,RND(8),1+*FX19
1090 VDU 19,1,RND(7);0;
1100 NEXT
1110 VDU 19,1,1;0;:SOUND 1,-15,0
,20
1120 COLOUR 3:PRINT TAB(0,15);"T
his is the correct equation.
     "
1130 PROCprint_equation:PROCpaus
e(200)
1140 ENDPROC
1150
1160 DEF PROCright
1170 COLOUR3:PRINT TAB(0,31);
1180 RX=RND(5):score=score+10/tr
ies
1190 IF RX=1 PRINT"Yippee";
```



```
1200 IF RX=2 PRINT"Hurray";
1210 IF RX=3 PRINT"Well done";
1220 IF RX=4 PRINT"WOW";
1230 IF RX=5 PRINT"Brilliant";
1240 PRINT", you got it right.";
STRING$(38-POS," ");
1250 SOUND 1,1,0,200
1260 FOR I%=1 TO 50
1270 VDU19,3,RND(7);0;:PROCpause
(4)
1280 NEXT
1290 VDU19,3,7;0;:SOUND &11,2,10
5,40
1300 ENDPROC
1310
1320 DEF PROCscores
1330 CLS:VDU19,1,6;0;19,3,5;0;
1340 COLOUR0:COLOUR131:PRINT'STR
ING$(120," ");TAB(15,2);"S C O R
E":COLOUR128
1350 COLOUR2:PRINT TAB(0,10);"Yo
u scored ";:COLOUR3:PRINT;score;:
COLOUR2:PRINT" %."
1360 COLOUR1:PRINT''''"This is "
;
1370 IF score<30 PRINT"very poor
."
1380 IF score>29 AND score<50 PR
INT"not very good."
1390 IF score>49 AND score<70 PR
INT"average."
1400 IF score>69 AND score<100 P
RINT"quite good."
1410 IF score=100 PRINT"excellen
t.":FOR I%=1 TO 100:SOUND 1,-15,R
ND(25)*4+100,1:NEXT:SOUND 1,-15,1
20,20
1420 VDU23,1,1;0;0;0;
1430 COLOUR3:PRINT''''"Would you
 like to try some more ?"''"( pre
ss Y or N )";
1440 VDU7:*FX21,0
1450 REPEAT key$=GET$
1460 UNTIL INSTR("YyNn",key$)
1470 CLS
1480 ENDPROC
1490
1500 DEF PROCinstructions
1510 VDU19,1,2;0;19,3,4;0;
1520 COLOUR129:COLOUR0:PRINT'STR
ING$(120," ");TAB(10,2);"CHEMICAL
 EQUATIONS":COLOUR2:COLOUR128
1530 PRINT''''"There are ten equ
ations to be balanced."''''"To bal
ance the equations the number of"
''"atoms on either side of the eq
uation"''"must be the same."
1540 PRINT''''"Eg.";:COLOUR1:PRIN
T TAB(12);"C + O";CHR$232;" ";CHR
$225;CHR$226;" CO":COLOUR2:PRINT'
"When balanced is -":COLOUR1:PRIN
T'TAB(11);"2C + O";CHR$232;" ";CH
R$225;CHR$226;" 2CO"
1550 COLOUR2:PRINT''"The first n
umber is 2,the second is 1"''"and
 the third is 2."
1560 COLOUR131:COLOUR2:PRINT TAB
(5,31);" Press the space bar to s
tart ";
1570 VDU7:*FX21,0
1580 REPEAT
1590 UNTIL GET=32
1600 COLOUR128:CLS
1610 ENDPROC
1620
1630 DEF PROCpause(delay)
1640 *FX21,0
1650 key$=INKEY$ delay
1660 ENDPROC
1670
1680 DEF PROCreLocate
1690 *FX200,2
1700 *TAPE
1710 *KEY9 "D%=PAGE-&E00:FOR I%=
PAGE TO TOP STEP4:!(I%-D%)=!I%:NE
XT:PRINT(TOP-D%)*255|MPAGE=&E00|M
OLD|MRUN|M"
1720 *FX21,0
1730 *FX138,0,137
1740 ENDPROC
1750
1760 DEF PROCget_data
1770 RESTORE:READ N%
1780 RESTORE (2110+RND(N%)*10)
1790 READ answer(0)
1800 FOR I%=1 TO answer(0)
1810 READ number(I%):answer(I%)=
0
1820 NEXT
1830 READ question$,N%
1840 RESTORE (2040+10*N%)
1850 READ title$
1860 CLS:COLOUR 3:COLOUR 129:PRI
NT'STRING$(120," ");TAB(0,2);titl
e$:COLOUR 128
1870 ENDPROC
1880
1890 DEF PROCprint_equation
1900 LOCAL I%:COLOUR 2:N%=0
1910 PRINT TAB((42-LEN question$
)DIV2,9);
1920 FOR I%=1 TO LEN question$
1930 q$=MID$(question$,I%,1)
1940 IF q$<"2" AND q$>"/" VDU 23
0+VAL q$
1950 IF q$="=" VDU 225,226
1960 IF q$="+" VDU 227,228
1970 IF q$="?" N%=N%+1:IF answer
(N%)>1 PRINT;answer(N%);
1980 IF q$>"@" AND q$<"[" OR q$>
"`" AND q$<"{" OR INSTR(" +()",q$
) PRINT q$;
1990 NEXT
2000 PRINT "      "
2010 ENDPROC
2020
2030 DATA 50 :REM number of equa
tions
2040 REM ** titles **
2050 DATA "    Reaction Of An Ele
ment With Oxygen"
2060 DATA "            Acid / Metal
 Reaction"
2070 DATA "            Acid / Base
 Reaction"
2080 DATA "        Oxidation Reduc
tion Reaction"
2090 DATA "        Action Of Heat
 On A Nitrate"
2100 DATA "      Reaction Of Meta
ls With Water"
2110 REM ** equations ** :number
 of answers,answer1,answer2...,eq
uation,title
2120 DATA 3,2,1,2,?H2 + ?O2 = ?H
2O,1
2130 DATA 3,1,1,1,?S + ?O2 = ?SO
2,1
2140 DATA 3,2,1,2,?Mg + ?O2 = ?M
gO,1
2150 DATA 3,2,1,2,?C + ?O2 = ?CO
,1
2160 DATA 3,2,1,2,?Cu + ?O2 = ?C
uO,1
2170 DATA 3,1,5,1,?P4 + ?O2 = ?P
4O10,1
2180 DATA 3,3,2,1,?Fe + ?O2 = ?F
e3O4,1
2190 DATA 4,1,2,1,1,?Zn + ?HCl =
 ?ZnCl2 + ?H2,2
2200 DATA 4,1,2,1,1,?Ca + ?HNO3
 = ?Ca(NO3)2 + ?H2,2
2210 DATA 5,3,8,3,4,2,?Cu + ?HNO
3 = ?Cu(NO3)2 + ?H2O + ?NO,2
2220 DATA 5,1,4,1,2,2,?Cu + ?HNO
3 = ?Cu(NO3)2 + ?H2O + ?NO2,2
2230 DATA 5,1,2,1,2,1,?Cu + ?H2S
O4 = ?CuSO4 + ?H2O + ?SO2,2
2240 DATA 4,1,2,1,1,?Mg + ?HCl =
 ?MgCl2 + ?H2,2
2250 DATA 4,1,2,1,1,?Mg + ?HNO3
 = ?Mg(NO3)2 + ?H2,2
2260 DATA 4,1,2,1,1,?Fe + ?HCl =
 ?FeCl2 + ?H2,2
2270 DATA 4,1,2,1,1,?CaO + ?HCl
 = ?CaCl2 + ?H2O,3
2280 DATA 4,1,2,1,1,?CuO + ?HCl
 = ?CuCl2 + ?H2O,3
2290 DATA 4,1,2,1,1,?CuO + ?HNO3
 = ?Cu(NO3)2 + ?H2O,3
2300 DATA 4,2,1,1,2,?NaOH + ?H2S
O4 = ?Na2SO4 + ?H2O,3
2310 DATA 4,2,1,1,2,?KOH + ?H2SO
4 = ?K2SO4 + ?H2O,3
2320 DATA 4,2,1,1,2,?NaOH + ?H2S
 = ?Na2S + ?H2O,3
2330 DATA 4,2,1,2,1,?Mg + ?SO2 =
 ?MgO + ?S,4
2340 DATA 3,2,1,2,?CO + ?O2 = ?C
O2,4
2350 DATA 4,1,3,2,3,?FeSO2 + ?H2
 = ?Fe + ?H2O,4
2360 DATA 5,1,4,1,2,1,?MnO2 + ?H
Cl = ?MnCl2 + ?H2O + Cl2,4
2370 DATA 3,2,1,2,?FeCl2 + ?Cl2
 = ?FeCl3,4
2380 DATA 4,1,1,2,1,?H2S + ?Cl2
 = ?HCl + ?S,4
2390 DATA 4,1,4,1,4,?PbS + ?H2O2
 = ?PbSO4 + ?H2O,4
2400 DATA 4,2,1,2,1,?Mg + ?CO2 =
 ?MgO + ?C,4
2410 DATA 4,1,3,2,3,?FeSO2 + ?CO
 = ?Fe + ?CO2,4
2420 DATA 5,1,2,1,1,2,?SO2 + ?H2
O + ?Cl2 = ?H2SO4 + ?HCl,4
2430 DATA 4,2,1,3,2,?H2S + ?SO2
 = ?S + ?H2O,4
2440 DATA 3,2,1,2,?SO2 + ?O2 = ?
SO3,4
2450 DATA 3,1,3,2,?N2 + ?H2 = ?N
H3,4
2460 DATA 4,2,1,2,1,?H2S + ?O2 =
 ?H2O + ?S,4
2470 DATA 4,2,3,2,2,?H2S + ?O2 =
 ?H2O + ?SO2,4
2480 DATA 3,2,2,1,?KNO3 = ?KNO2
 + ?O2,5
2490 DATA 3,2,2,1,?NaNO3 = ?NaNO
2 + ?O2,5
2500 DATA 4,2,2,4,1,?Ca(NO3)2 =
 ?CaO + ?NO2 + ?O2,5
2510 DATA 4,2,2,4,1,?Mg(NO3)2 =
 ?MgO + ?NO2 + ?O2,5
2520 DATA 4,2,2,4,1,?Zn(NO3)2 =
 ?ZnO + ?NO2 + ?O2,5
2530 DATA 4,2,2,4,1,?Pb(NO3)2 =
 ?PbO + ?NO2 + ?O2,5
2540 DATA 4,2,2,4,1,?Cu(NO3)2 =
 ?CuO + ?NO2 + ?O2,5
2550 DATA 4,2,2,2,1,?AgNO3 = ?Ag
 + ?NO2 + ?O2,5
2560 DATA 3,1,1,2,?NH4NO3 = ?N2O
 + ?H2O,5
2570 DATA 4,2,2,2,1,?K + ?H2O =
 ?KOH + ?H2,6
2580 DATA 4,2,2,2,1,?Na + ?H2O =
 ?NaOH + ?H2,6
2590 DATA 4,3,4,1,4,?Fe + ?H2O =
 ?Fe3O4 + ?H2,6
2600 DATA 4,1,2,1,1,?Ca + ?H2O =
 ?Ca(OH)2 + H2,6
2610 DATA 4,2,2,2,1,?Li + ?H2O =
 ?LiOH + ?H2,6
```

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Don't miss out on the mass of material that's appeared in *Electron User* over the past few months. Bring yourself up to date with this back issue bundle, packed with games, utilities, features and programming tutorials.

Here's what you'll find in the February 1989 – July 1989 bundle:

February 1989 issue:
Games: Slippery Sam. *Utilities:* Supercharge your programs. Verfy tape programs. *Features:* Random access filing. Adventure hints. Reverse Polish tutor. *Reviews:* Pixel Perfect DTP. Preparing for breakdowns.

March 1989 issue:
Games: Taktiks, Trivia Test. Bomb Disposal. Sprog. *Utilities:* Search and Replace, Poetry. *Features:* Map of The Nine Dancers. Disc directories explored. *Reviews:* Repton Infinity, Question of Sport, Zenon, Last Ninja. Advanced File Manager.

April 1989 issue:
Games: Diamonds – a mind bending puzzle. *Utilities:* Pattern fill routine, automatic program saver, Home Finance Manager. *Features:* Input routines explained, disc drives revealed, palindromic numbers explored. *Reviews:* Sam 6, Exile, Orbital.

May 1989 issue:
Games: Eliminator. *Utilities:* EZ Type, DFS disc formatter. *Features:* Tournament sorts, Party Cocktail Creator, Landscape Designer, Fractal Generator. *Reviews:* Barbarian II, Circus Games, Superman, Mode 7 Simulator Rom.

June 1989 issue:
Games: Tic Tac Rhymes, Duel. *Features:* ADFS osword calls explained, creating customised tapes, maps to Woodbury End and Palace of Magic. *Utilities:* Disc-based database, new CIRCLE graphics command, Morse Code Tutor. *Reviews:* Holed Out, Tank Attack, Sam 7.

July 1989 issue:
Games: Jet Bike arcade adventure, educational fun with Ladder Adder, Time bomb arcade fun. *Utilities:* Speedy Reader. *Reviews:* Predator, Stormcycle, Sam 8. *Features:* Jafa Systems interview, Disc error codes documented, 10 Liners, Philosophers Quest and Palace of Magic mapped.

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BACK ISSUE BUNDLE

Everything you ever wanted to know about your Electron but were afraid to ask is in these back issues of Electron User

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Get on the ball!

Pick up your hockey stick and try your hand at Stuart Bain's Rollerball, a fast paced two player game

ROLLERBALL is rather loosely based on the game of hockey. In this fast-paced computerised version there are only two players – it's a battle between you and a friend – you can't play against your Electron.

At the start of the game each player stands on his goal line and the ball is placed in the centre of the pitch. You must dash to the ball – attempting to get there before your opponent – and using your stick to push it ahead of you, dodge round your opponent and knock it into the back of the net. The first player to score 10 goals is the contest winner.

If your opponent gains control of the ball his running speed is reduced, so this provides an ideal opportunity for you to catch up and tackle him. Keep your wits about you and shield the ball with your bat when you gain possession.

The controls might feel strange at first, but they are easy to get used to. You can rotate your stick so that it is pointing in any of the eight compass directions and move in that direction pushing the ball in front of you.

Your controls are Z and X to rotate left and right, and Control to run forward. Your opponent's controls are > and ? for swivelling round and Return to run forward.

```
   10 REM Rollerball
   20 REM By Stuart Bain
   30 REM (c) Electron User
   40 PROCinit:ONERRORIFERR<>17MO
DE6:REPORT:PRINT" at line ";ERL:E
ND
   50 REPEATMODE6:PROCinstruct
   60 MODE4:sc1%=0:sc2%=0:REPEATP
ROCscreen
   70 REPEATTIME=0:PROCmove(0):PR
OCmove(1):VDU31,bx%,by%,232:REPEA
TUNTILTIME>10:UNTILgoal%
   80 SOUND1,-12,80,4:SOUND1,-12,
128,5:UNTILsc1%>9ORsc2%>9
   90 IFsc1%>9winX=1ELSEwinX=2
  100 PRINTTAB(14,16)"PRESS SPACE
"
  110 REPEATPRINTTAB(7,13)"Player
 ";winX" wins by ";ABS(sc1%-sc2%)
" goals"
  120 FORI=0TO250:NEXT:PRINTTAB(7
,13)SPC25
  130 FORI=0TO250:NEXT
  140 UNTILINKEY-99
  150 UNTILO
  160 DEFPROCmove(PX)
  170 X%=X%(PX):Y%=Y%(PX):D%=D%(P
X):IFPXPROCkey2:ELSEPROCkey1
  180 IFmoveX%X%=X%+HX(D%):Y%=Y%+V
%(D%)
  190 x%=X%*32:y%=(32-Y%)*32-1:IF
POINT(x%,y%)ORPOINT(x%+28,y%)ORPO
INT(x%,y%-28)ORPOINT(x%+28,y%-28)
X%=X%(PX):Y%=Y%(PX):moveX=FALSE
  200 IFNOTmoveXANDD%=D%(PX)ENDPR
OC
  210 IFPOINT(x%+16,y%-16)ANDmove
XPROChitball:ELSEVDU31,X%(PX),Y%(
PX),32,31,X%,Y%,224+D%
  220 X%(PX)=X%:Y%(PX)=Y%:D%(PX)=
D%:ENDPROC
  230 DEFPROCkey1:D%=D%+INKEY-98-
INKEY-67:IFD%<0D%=7ELSEIFD%=8D%=0
  240 moveX=INKEY-2:ENDPROC
  250 DEFPROCkey2:D%=D%+INKEY-104
-INKEY-105:IFD%<0D%=7ELSEIFD%=8D%
=0
  260 moveX=INKEY-74:ENDPROC
  270 DEFPROChitball
  280 X%=X%(PX):Y%=Y%(PX):hX=HX(D
%):vX=VX(D%)
  290 REPEATmoveX=0:A%=bx%+hX:B%=
by%+vX
  300 IFA%=X%(1-PX)ANDB%=Y%(1-PX)
I%=RND(8)-1:hX=HX(I%):vX=VX(I%):m
oveX=TRUE
  310 UNTILNOTmoveX:x%=A%*32:y%=1
023-B%*32
  320 IFPOINT(x%,y%)ORPOINT(x%+28
,y%)ORPOINT(x%,y%-28)ORPOINT(x%+2
8,y%-28)A%=bx%:B%=by%
  330 IFA%=1AX=2ELSEIFA%=38AX=37
  340 IFB%=1BX=2ELSEIFBX=25BX=24
  350 IFA%<3ANDB%>8ANDB%<18goal%=
TRUE:sc2%=sc2%+1ELSEIFA%>36ANDB%>
8ANDB%<18goal%=TRUE:sc1%=sc1%+1
  360 VDU31,bx%,by%,32,31,AX,BX,2
32:bx%=AX:by%=BX:hX=0:vX=0:ENDPRO
C
  370 DEFPROCinit
  380 VDU23,224,255,24,24,24,24,2
4,24,24,23,225,16,8,4,10,17,32,64
,128,23,226,1,1,1,255,255,1,1,1,2
3,227,128,64,32,17,10,4,8,16
  390 VDU23,228,24,24,24,24,24,24
,24,255,23,229,1,2,4,136,80,32,16
,8,23,230,128,128,128,255,255,128
,128,128,23,231,8,16,32,80,136,4,
2,1
  400 VDU23,232,24,126,126,255,25
5,126,126,24
```

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CONTROLS	
Z X Control	Player 1 Rotate left Rotate right Forward
> ? Return	Player 2 Rotate left Rotate right Forward

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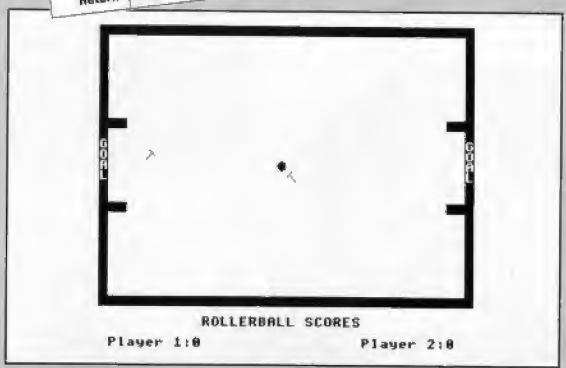
```
  410 DIMX%(1),Y%(1),D%(1),MX(7),
V%(7):RESTORE430:FORI%=0TO7:READX
I%(I%),VX(I%):NEXT
  420 ENDPROC
  430 DATA 0,-1,1,-1,1,0,1,1,0,1,
-1,1,-1,0,-1,-1
  440 DEFPROCscreen
  450 CLS:VDU23,1,0;0;0;0;:RESTOR
E510:FORI%=0TO1:READX%(I%),Y%(I%)
,D%(I%):NEXT:bx%=19:by%=13:h%=0:v
%=0:goal%=FALSE
  460 PRINTTAB(11,28)"ROLLERBALL
SCORES"TAB(1,30)"Player 1:";sc1%T
AB(28,30)"Player 2:";sc2%
  470 COLOUR129:PRINTTAB(0,0)SPC4
DTAB(0,26)SPC4D:FORI%=1TO25:VDU31
,0,I%,32,31,39,I%,32:NEXT
  480 PRINTTAB(1,9)SPC2TAB(1,17)S
PC2TAB(37,9)SPC2TAB(37,17)SPC2
  490 COLOUR0:FORI%=1TO4:PRINTTAB
(0,10+I%)MID$("GOAL",I%,1)TAB(39,
10+I%)MID$("GOAL",I%,1):NEXT
  500 COLOUR128:COLOUR1:PRINTTAB(
5,12)CHR$22;6;TAB(34,14)CHR$23;0;TAB(
19,13)CHR$232:ENDPROC
  510 DATA5,12,2,34,14,6
  520 DEFPROCinstruct
  530 CLS:VDU23,1,0;0;0;0;:PROCti
tle
  540 PRINT''" In this fun game y
ou try to beat your"''" friend by
 being the first to score 10"''"
goals. You move the ball around t
he"
  550 PRINT'" screen by pushing i
t with the 'I' clubs"'" which eac
h player controls. Push the"''" b
all into your opponents goal to s
core."
  560 PROCspace:PROCtitle
  570 PRINT'SPC16"CONTROLS"'SPC4"
Player 1"SPC16"Player 2"''SPC5"'
Z'"SPC5"ANTI-CLOCKWISE"SPC5"'>'"
  580 PRINT'''SPC5"'X'"SPC7"CLOCK
WISE"SPC8"'?"'''SPC5"'CTRL'"SPC
7"MOVE"SPC8"'RET'"
  590 PROCspace:ENDPROC
  600 DEFPROCspace:PRINTTAB(14,24
)"PRESS SPACE";:REPEATUNTILINKEY-
99:ENDPROC
  610 DEFPROCtitle:CLS:PRINTTAB(1
4,1)"------------"'TAB(13)CHR$232
" ROLLERBALL "CHR$232'TAB(14)"---
----------":ENDPROC
```



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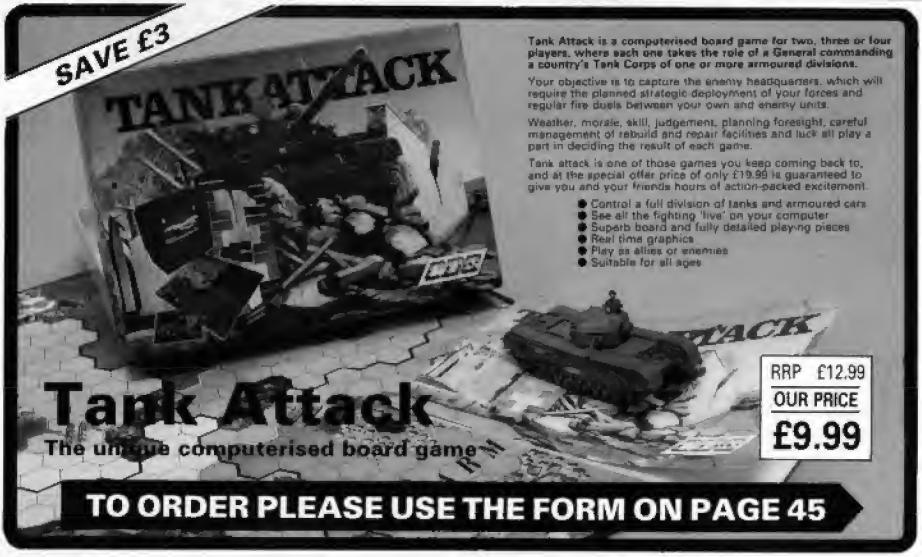

Tank Attack is a computerised board game for two, three or four players, where each one takes the role of a General commanding a country's Tank Corps of one or more armoured divisions.

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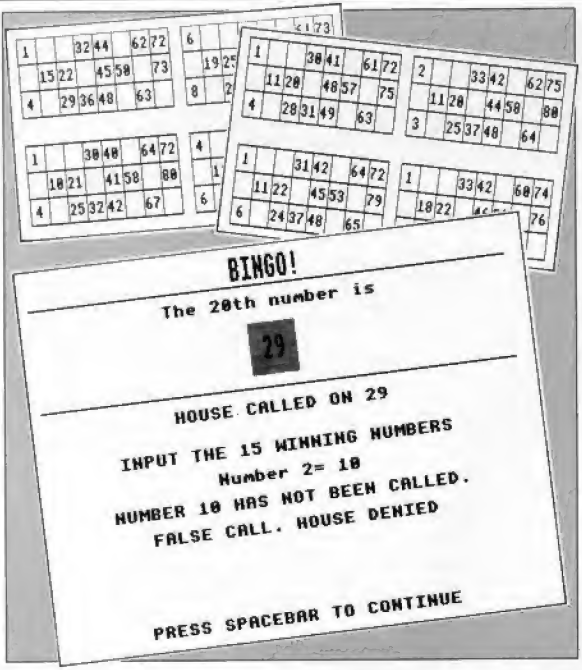

Eyes down!

Phil Ord presents an entertaining DIY Bingo game for all the family

CLICKETY click, 66... On its own number one... Two fat ladies 88... Blind five oh – House! Yes, you've guessed it, Bingo comes to the Electron. This superb version from Phil Ord is a complete do-it-yourself Bingo kit specially designed so you can produce your own games for all the family to play.

The kit consists of two programs. The first, called Cards, is used to create the Bingo cards and you'll need a printer to run them out. The second program is used when playing the game and calls out the numbers.

First enter and save Cards. Make sure the printer is plugged in and switched on then run the program. Eight cards will be drawn on screen and then dumped to the printer. When they have all been printed cut them out and you are ready to play.

The screen dump procedure is written in Basic and will work with Epson-compatible printers. If you have a non-standard machine the codes setting up the paper feed and bit image mode may have to be altered. To help, the routine contains REMs explaining what each line does. It takes around 10 minutes to print eight cards.

The second program, Caller, should now be typed in and saved. Run it to play Bingo. It will display the numbers on the screen and you simply tick them off your card. When a player has ticked off all of his or her numbers on the card press H and the Electron will then check the card's numbers so there is no cheating.

If at any time you need to check all the numbers called press R to reprint them all on screen.

```
   10 REM Bingo Cards
   20 REM By Philip Ord
   30 REM (c) Electron User
   40 MODE4
   50 DIM num(3)
   60 t%=RND(-TIME)
   70 VDU5:GCOL0,1
   80 PROCgrid(4,1020,80,1020)
   90 PROCgrid(664,1020,740,1020)
  100 PROCgrid(4,760,80,760)
  110 PROCgrid(664,760,740,760)
  120 MOVE0,528:PRINTSTRING$(40,"
-")
  130 PROCgrid(4,460,80,460)
  140 PROCgrid(664,460,740,460)
  150 PROCgrid(4,200,80,200)
  160 PROCgrid(664,200,740,200)
  170 PROCprint(8,1000)
  180 PROCprint(668,1000)
  190 PROCprint(8,740)
  200 PROCprint(668,740)
  210 PROCprint(8,440)
  220 PROCprint(668,440)
  230 PROCprint(8,180)
  240 PROCprint(668,180)
  250 PROCdump
  260 END
  270
  280 DEFPROCgrid(X%,Y%,x%,y%)
  290 MOVEX%,Y%:DRAWX%+608,Y%:DRA
WX%+608,Y%-192:DRAWX%,Y%-192:DRAW
X%,Y%
  300 FORJ=1 TO 8
  310 MOVEx%,y%:DRAWx%,y%-192:x%=
x%+76
  320 NEXT
  330 FORY=1 TO 2
  340 MOVEX%,Y%-64:DRAWX%+608,Y%-
64:Y%=Y%-64
  350 NEXT
  360 ENDPROC
  370 DEFPROCprint(X%,Y%)
  380 K=0
  390 FORJ=1 TO 6
  400 FORI=1 TO 3
  410 IF J=1 num(I)=K+RND(9) ELSE
 IF J=6 num(I)=K+RND(10) ELSE num
(I)=(K-1)+RND(10)
  420 NEXT
  430 IFnum(2)=num(1) GOTO400
  440 IFnum(3)=num(2) OR num(3)=n
um(1) GOTO400
  450 FORS=1 TO 3
  460 FORI=2 TO 1 STEP-1
  470 IF num(I)>num(I+1) PROCswap
  480 NEXT
  490 NEXT
  500 ra%=RND(3):rb%=RND(2)+1
  510 IF J=1 MOVEX%+16,Y%:PRINT;n
um(1):MOVEX%+16,Y%-128:PRINT;num(
rb%)
  520 IF J=2 MOVEX%+76,Y%-64:PRIN
T;num(ra%)
  530 IF J=3 MOVEX%+152,Y%-64:PRI
NT;num(1):MOVEX%+152,Y%-128:PRINT
;num(rb%)
  540 IF J=4 MOVEX%+228,Y%:PRINT;
num(1):MOVEX%+228,Y%-128:PRINT;nu
m(rb%)
  550 IF J=5 MOVEX%+304,Y%:PRINT;
num(1):MOVEX%+304,Y%-64:PRINT;num
(2):MOVEX%+304,Y%-128:PRINT;num(3
)
  560 IF J=6 MOVEX%+380,Y%-64:PRI
NT;num(ra%)
  570 IF J=7 MOVEX%+456,Y%:PRINT;
num(1):MOVEX%+456,Y%-128:PRINT;nu
m(rb%)
  580 IF J=8 MOVEX%+532,Y%:PRINT;
num(1):MOVEX%+532,Y%-64:PRINT;num
(rb%)
  590 K=K+10
  600 NEXTJ
  610 ENDPROC
  620 DEFPROCswap
  630 num=num(I):num(I)=num(I+1):
num(I+1)=num
  640 ENDPROC
  650
  660 DEF PROCdump
  670 *FX6,255
  680 *FX3,10
  690 VDU 27,64:REM Reset printer
  700 VDU 27,65,4:REM 4/72in line
 spacing
  710 FOR Y%=1020 TO 0 STEP -8
  720 VDU 27,75,64,1:REM Bit imag
e mode
  730 FOR X%=0 TO 1276 STEP 4
  740 B%=8 : P%=0
  750 FOR I%=0 TO 6 STEP 2
  760 IF POINT(X%,Y%-I%) P%=P%+B%
  770 B%=B% DIV 2
```

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```
780 NEXT
790 VDU PX
800 NEXT
810 VDU 10
820 NEXT
830 VDU 27,64:REM Reset printer
840 *FX3
850 ENDPROC
```

```
  10 REM Bingo Caller
  20 REM By Philip Ord
  30 REM (c) Electron User
  40 MODE1
  50 DIMNX(80)
  60 VDU23,1,0;0;0;0;
  70 PROCrand:GOTO110
  80 DEFPROCrand
  90 FOR I%=1 TO 80:NX(I%)=I%:NE
XT:FOR I%=80 TO 2 STEP-1:C%=RND(I
%):T%=NX(C%):NX(C%)=NX(I%):NX(I%)
=T%:NEXT
 100 ENDPROC
 110 PROCbig("BINGO!",17,2)
 120 ENVELOPE1,1,135,198,173,151
,173,212,126,0,0,-126,126,126
 130 ENVELOPE2,1,86,105,162,238,
194,167,126,0,0,-126,126,126
 140 MOVE0,888:DRAW1279,888
 150 MOVE0,640:DRAW1279,640
 160 FOR I=1 TO 80
 170 A=NX(I):IF A<10 E=2 ELSE E=
1
 180 IF RIGHT$(STR$(I),1)="1" a$
="st" ELSE IF RIGHT$(STR$(I),1)="
2" a$="nd" ELSE IF RIGHT$(STR$(I)
,1)="3" a$="rd" ELSE a$="th"
 190 IFI>10 AND I<20 a$="th"
 200 PROCbig(STR$(A),c,1):VDU26:
COLOUR128
 210 SOUND1,-15,170,1
 220 PRINTTAB(6,13)"SPACEBAR FOR
 THE NEXT NUMBER"TAB(9,15)"OR HIT
 H TO CALL HOUSE"TAB(12,17)"PRESS
 R TO RECAP"
 230 *FX21
 240 W$=GET$:IF W$<>" " AND W$<>
"H" AND W$<>"R" GOTO240
 250 IF W$="H" PROChouse
 260 IF W$="R" PROCrecap
 270 NEXT
 280 GOTO730
 290 DEF PROCbig(str$,C,R)
 300 IF str$="BINGO!" GOTO330
 310 PRINTTAB(11,5)"The ";I;e$;"
number is"
 320 VDU28,18,10,21,7:COLOUR129:
CLS
 330 PRINTTAB(C,R);
 340 LOCAL I%,A%
 350 FORI%=1TOLEN(str$)
 360 ?&70=ASC(MID$(str$,I%,1))
 370 A%=10:X%=&70:Y%=0:CALL &FFF
1
 380 FOR J%=0TO1
 390 VDU23,224
 400 FORK%=2TO9
 410 VDU?(&70+4*J%+K%DIV2)
 420 NEXT
 430 VDU224,10,8
 440 NEXT
 450 VDU11,11,9
 460 NEXT
 470 ENDPROC
 480 DEFPROChouse
 490 SOUND1,2,100,40:FORD=1 TO 1
000:NEXT
 500 VDU28,0,29,39,13:CLS:VDU26:
PRINTTAB(11,13)"HOUSE CALLED ON "
;A;
 510 FORinp=1 TO 15
 520 PRINTTAB(6,16)"INPUT THE 15
 WINNING NUMBERS"TAB(14,18)"Numbe
r ";inp;"=":VDU7,23,1,1;0;0;0;:IN
PUTTAB(24,18)wn:VDU23,1,0;0;0;0;
 530 FORf=1 TO 1
 540 IF wn=NX(f) f=1:WN=TRUE:PRO
Ccorrect:NEXT:GOTO580
 550 IF wn<>NX(f) WN=FALSE
 560 NEXT f
 570 IF WN=FALSE PROCincorrect:i
np=15:NEXT:ENDPROC
 580 NEXT inp
 590 PROCwinner:END
 600 ENDPROC
 610 DEFPROCcorrect
 620 PRINTTAB(15,20)"Confirmed."
:FORD=1 TO 200:NEXT:PRINTTAB(24,1
8);SPC2;TAB(15,20);SPC10
 630 ENDPROC
 640 DEFPROCincorrect
 650 SOUND1,-15,20,4:SOUND1,-15,
10,8
 660 PRINTTAB(5,20)"NUMBER ";wn;
" HAS NOT BEEN CALLED."TAB(8,22)"
FALSE CALL. HOUSE DENIED"
 670 PRINTTAB(7,29)"PRESS SPACEB
AR TO CONTINUE":REPEATUNTILGET=32
 680 VDU28,0,29,39,13:CLS:VDU26
 690 ENDPROC
 700 DEFPROCwinner
 710 SOUND1,1,100,40
 720 VDU28,0,29,39,13:CLS:VDU26:
PRINTTAB(17,14)"BINGO!"TAB(13,20)
"HOUSE CORRECT."
 730 PRINTTAB(6,24)"PRESS SPACEB
AR FOR NEXT GAME":REPEATUNTILGET=
32:RUN
 740 ENDPROC
 750 DEFPROCrecap
 760 VDU28,0,29,39,13:CLS:VDU26
 770 PRINTTAB(17,13)"RE-CAP"'
 780 FORrc%=1 TO 1
 790 PRINT;NX(rc%);",";
 800 IF rc% MOD13=0 PRINT'
 810 NEXT
 820 GOTO670
 830 ENDPROC
```


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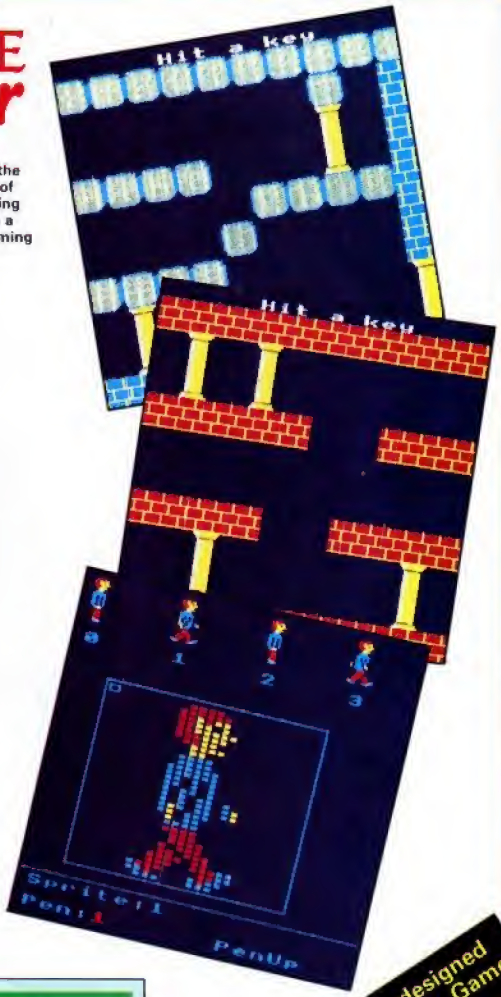

Screens designed using Arcade Game Creator

Arcade Game Creator	
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MICRO MESSAGES

Putting the !Boot in

HAVING upgraded my Electron with a Slogger Master Ram board, Pres Plus 1 and Plus 3, and a Panasonic KX-P1081 printer, I find any articles relating to these peripherals of great interest.

I realise that you have given quite a bit of information on them already, but there are still some things that puzzle me. I have often envied the way that numerous files on the Welcome disc are accessed using !Boot, and I have several times tried to emulate this facility on my own discs but without success, so how about a bit of tuition on this command?

Another topic I would like to know more about is disc error messages. Many are self-explanatory, but sometimes when clearing the screen after using a file I get the message Bad Sum. *Although the remedy for this is simple, I cannot understand from the manual what the reason is. One I find incompre-hensible is Channel on channel n.*

I have tried without success to make use of the Letterhead Designer program from your March 1988 issue. I have checked and rechecked the listing, including the alterations suggested by John Bloxham in June's Micro Messages. I think a published listing showing how the illustrated Letterhead was achieved would have been preferable to a lot of erudite explanation.

Now that I have taken out a subscription to Electron User I look forward to the postmen's visit each month – it's one of life's bright spots, so please keep up the good work. – **J. D. Hatfield, Hull.**

● Creating !Boot files is quite straightforward. Copy the Build Utility from the Library directory on your welcome disc to your work disc. Entering the following lines will create a !Boot file that will load and run a file called Menu:

```
*BUILD !Boot
CHAIN "Menu"
```

Press Escape after typing the last line and enter:

```
*OPT4,3
```

When you press Shift+Break the instructions in the !Boot file will be executed as if they were typed in at the keyboard. Some programs corrupt the disc filing system's reserved workspace when they are run. If this happens then you will get the error messages you mention. To prevent this, press Control+Break after each program.

The letterhead accompanying the article was created using the program listed and was simply drawn freehand. Please check your typing carefully if your version doesn't work properly.

Knock out program

I HAVE been searching for a program which simulates the game Knock Out Whist and in your July 1988 issue I noticed one. I would like to know if it possible to buy this game on tape, as I do not wish to type in the program. – **Glen Cooper, Billingham, Cleveland.**

● Sorry, it isn't available on tape.

Calling too many roms

I HAVE an Electron with an AP6 expansion but have found that two of my roms respond to the same call. Is there any way to disable one rom temporarily without physically unplugging it? Your help would be greatly appreciated. – **R. A. Stevens, Portsmouth.**

● The best solution is to add a utility rom such as ADT to your micro. This has a built in UNPLUG command to remove unwanted roms. If the first rom is intercepting calls meant for the second one a simple alternative is to swap the rom positions. Also try storing a zero in &2A0+rom number to disable the one causing problems.

Printing on a budget

COULD you recommend some printers of reasonable standard and price which I could use to produce listings and hard copies of text from a word processor. I have already bought the Plus 1 expansion.

Secondly, could you recommend an ideal package, either View and Viewsheet cartridges or the Mini Office package, which could be of use to me and also compatible with the printer? – **Carwin Jones, Fareham, Hants.**

● The Star LC10 at around £175 and Panasonic KX-P1081 at around £139 are two excellent printers available from Watford Electronics, Jessa House, 250 Lower High Street, Watford WD1 2AN. Mini Office can be used with these printers, as can View and Viewsheet. However the last two are far superior, being rom-based and extremely powerful.

Looking for Pascal

I AM trying to find a Pascal rom cartridge suitable for use with my Electron and Plus 1. Do you know where I can find one? I have a Pres AP6. Would a Pascal rom suitable for the BBC Micro be compatible with the Electron? – **Richard Fawcett, Edinburgh.**

● Acornsoft produces a superb implementation of Pascal. However, it is difficult to find so you'll have to ring round the suppliers. The BBC Micro version of Pascal probably runs, but the editor's function keys will not be suitable, so it should be avoided.

Electron on Radio One

MY Electron is interfering with the reception of my radio. This means I can't listen to Radio One while playing with my computer. Do you have any suggestions as to how I can tackle the problem? – **Eddie Irwin, Camberley, Surrey.**

● We have heard of this sort of thing before, and apart from shielding your micro by encasing it in metal foil there's nothing you can do. Even this solution isn't recommended, as the machine might overheat and the foil could short circuit the pcb.

Disappearing Bowls

A WHILE ago I bought Indoor Sports from Tynesoft. Unfortunately, there seems to be some kind of graphics corruption with 10-Pin Bowling. When the bowler starts to run with the bowl, the top section of the scores and the portion of the screen below the alley disappear. When the bowler throws the bowl they reappear.

Also when the bowl is shown hitting the pins the top of the screen is black. This is an annoying problem and I am sure it is not meant to happen, because the sections cut off are not always the same and the edge of the cut-off picture flickers.

I disconnected my Plus 1, but this makes no difference and I have no other add-ons. Please could you tell me whether your reviewer had any similar problems with his

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◄ From Page 35

review copy. I have the Pres Battery-Backed Sideways Ram and I have always had problems using LOADROM.

To load a rom image including MAKEROM and PRNTBUF, I have to keep switching the computer off and on, trying LOADROM each time until it successfully works. I usually have to switch the machine off and on at least six times.

What usually happens when I try to use LOADROM is that either the computer crashes followed by a continuous beep – only Break stops this – or the message Syntax error, Bad Program *appears. I have tried locking and unlocking the ram, but this makes no difference.*

I have been trying to convert your utilities, for example BOS and Find and Replace, to run from sideways ram. As they use Basic rom routines I am having problems as only one rom can be paged in at a time. Is there any way in which a program in sideways ram can call a Basic rom routine and then continue after the call?

I cannot miss this opportunity to say that your magazine is excellent. The format is great – **S. Creed, Cowley, Oxford.**

● The Slogger Turbo Driver can cause the blackout problems you mention, as it makes the Electron run too fast and the timing of interrupt routines is wrong. Switch it off if this is the case.

You can easily cause problems with battery backed sideways ram by loading in a corrupt rom image or a partially working one. The solution is to switch off, remove the cartridge, switch on, insert the cartridge and then try to load your rom images.

Sounds rather interesting

I WAS experimenting with the SOUND command on my Electron when I came across some unusual noises, none of which I'd heard before.

I have never seen a program in books or magazines which gives sounds other than plain notes or the two noises on channel zero. Enter and run this to hear some unusual sounds:

```
10 FOR I=1 TO 2
20 SOUND 1,-15,0,-1
30 ?&822=10
40 ?&823=2
50 NEXT
```

By changing the 10 and 2 in lines 30 and 40 other sounds can be generated. – **Richard Fryer, Edinburgh.**

All programs printed in this issue are exact reproductions of listings taken from running programs which have been thoroughly tested.

However, on the very rare occasions that mistakes may occur corrections will be published as a matter of urgency. Should you encounter error messages when you type in a program they will almost certainly be the result of your own typing mistakes.

Unfortunately we can no longer answer personal programming queries concerning these mistakes. Of course letters about suggested errors will be investigated without delay, but any replies found necessary will only appear in the mail pages.

Marginal amendment

WHEN I use the Label Printer utilitiy from the October 1987 issue of Electron User *I find that when I select enlarged text with margin, I get an enlarged margin which throws the text to the right edge of the label. I have written a small modification to line 950 which cures this for the Amstrad DMP2000 printer:*

```
950 IF FNyn VDU 2,1,27,1,ASC"
W",1,1,3:VDU 2,1,27,1,ASC"D",1,
4,1,0,3
```

The following change should also be made:

```
830 VDU 1,27,1,ASC"W",1,1,,3:
VDU 2,1,27,1,ASC"D",1,8,1,0,3
```

The first halves the margin size – the standard eight-space margin size becomes four spaces. In enlarged mode this means the four-space margin is about the same width as the eight-space margin in normal mode.

The second resets the margin each time to eight spaces for normal mode, but automatically alters it for enlarged again when enlarged is used. – **Robert Goddard, Rugby, Warwickshire.**

Jetting around with Droid

I TOOK out a subscription to Electron User *with the free tape offer and I think it's great. I hope the tapes are still on offer when I come to renew my subscription.*

In reply to Alexander Bowyer's request for help in June's issue, the following advice should sort his Codename: Droid problems out.

To get the jet-pack on level three, sector two he should pick up the key that can be found high up towards the left of the jet-pack on the same sector, ensuring that it is the first item picked up after collecting the spring on level two, sector two.

I am interested in upgrading my Electron to a disc system and am very keen on the Pres Advanced Plus 3 MkII. I have yet to buy a Plus 1, but if I bought the disc system from Pres would I need a disc interface? – **Michael Severn, Preston, Lancashire.**

● You'll need a Plus 1 to use an AP3. The AP3 is a disc interface that plugs into it.

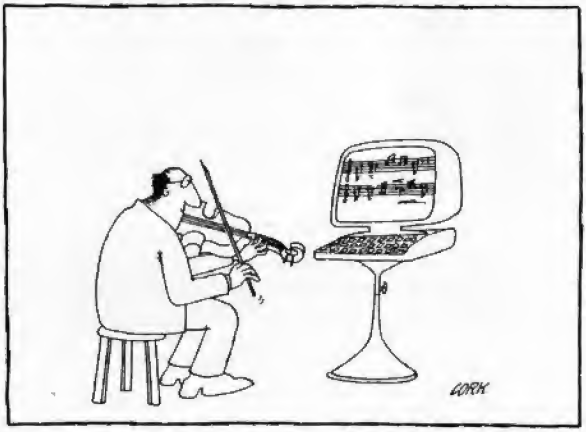
Who's who in View?

Who is Mark Colton? Does anybody know? Why his name is printed out when the word Daytona is entered into View? – **Andrew Sellor, Old Hutton, Kendal.**

● We are just as puzzled as you Andrew.

Achieving the impossible

MR BIBBY from Wrexham is correct, Repton Infinity is impossible. I also had the game for Christmas and soon found that two screens were impossible. I contacted Superior Software and was told that the game was bugged and that it was in the process of



producing a new one.

The replacement game, which is not impossible, arrived about a month later. So, Mr Bibby and anyone else with a faulty copy should either take it back to the supplier or contact Superior Software. – **D. Hare, Liverpool.**

● This month's Arcade Corner on Page 38 features many hints and tips for Repton Infinity.

Memory trouble

I have recently bought an Electron with both a Plus 1 and Plus 3 attached. I intend to use my machine primarily for word processing. However when I have a View rom installed the lack of useable memory is a handicap. What's the easiest and cheapest way to add more memory for word processing? – **Stuart Bookless, Hemlington, Middlesbrough.**

● The trouble isn't View, but the Plus 3. You could add Pres' Battery Backed Ram Cartridge and E00 ADFS to solve your memory problem. There is a cheaper way though: View can handle files much larger than will fit in the memory using EDIT. You should be able to edit files up to 150k long by entering:

```
EDIT filein fileout
```

Where *filein* is the old file you want to edit, and *fileout* is the new edited file you wish to create. When you have finished enter FINISH.

Weaving a tangled web

I NOTICED a short listing in the April issue which converts Basic programs into machine code. I am confused as to how it is used, could you please explain.

Also, I entered the 10 Liners program Spider's Web from the same issue into a BBC Micro and got different results from those shown in the magazine. Why is this? – **S. Walters, Ruislip Gardens, Middlesex.**

● The Basic to machine code converter was an April fool joke – it's not possible to do this in the manner described. Spider's Web should give the same results on the BBC Micro and Electron. Have you made a typing error and come up with a completely new pattern?

Gone but not forgotten

I TYPED in the Disc Drive Toolkit program from your January 1988 issue, but unfortunately did not read the introductory text. The disc I had in the drive at the time contained a lot of valuable files.

As you warn in the text, the root directory of my disc was corrupted and I repeatedly got the Broken directory *error message, despite all my efforts to recover the data. Please, before I have a nervous breakdown, could you tell me if there is a way that I can recover the files?*

In July 1988's Electron User *the Knock Out Whist card game has an annoying habit of producing more than one of the same card, such as two Ace of Hearts.*

Is there a way in which I can change this? Lastly, is there a back issue of Electron User *which tells me how to make the most of the 32k sideways ram?* – **Kenneth MacLeod, Cleckmannan-shire, Scotland.**

● Unfortunately you can't recover the lost files on your disc, they are gone forever. We haven't experienced the card duplication problem you mention. Check your typing carefully, as a simple slip could cause this error.

The most recent article featuring sideways ram was in our July 1987 issue. There you'll find a listing to execute a !Boot file on disc automatically when the micro is switched on.

Cheaper connection

PLEASE could you tell me if there is an RS423 interface for modems to the Electron that retails at less than £30, as Slogger's is too expensive for me. – **I. White, Wimbledon Park, London.**

● We don't know of anyone producing an interface providing an RS423 socket.

Multi-shade screen dumps

I HAVE got an Electron, a First Byte printer interface and an Epson FX80 printer. Can you tell me how to produce multi-shade screen dumps?

I have been having problems with games freezing once they've been loaded. Can you suggest what may be wrong and if so how it can be cured. Finally, where can I get hold of a copy of US Gold's Impossible Mission? – **K. W. Thomas, Modbury, Devon.**

● We have covered the tricky problem of screen dumps several times over the past few years, but the back issues are no longer available so below is an Epson compatible screen dump.

This routine prints black and white correctly, however, most screen dumps look better if the colours are reversed. To do this change line 260 to read:

```
260 LDA data,Y:JSR oswrch
```

The program assembles a machine code routine to &C00. To dump a screen first load it and then CALL &C00.

The key to unlocking frozen games may lie with the ULA chip. Keith Watts in the November 1988 Micro Messages solved this by removing the ULA, sliding it back and forth in the carrier, then replacing it. Brian Giggins – January 1989 Micro Messages – also reports that this technique works.

We cannot locate a distributor with stocks of Impossible Mission. Can any readers help?

```
   10 REM Screen Dump
   20 REM CALLL &C00 to dump
   30 oswrch=&FFEE:osbyte=&FFF4:o
sword=&FFF1
   40 x=&70:y=&72:block=&80
   50 FOR pass=0 TO 2 STEP 2
   60 P%=&C00
   70 IF pass=2 PRINT"Start...&";
~P%
   80 [ OPT pass
   90 LDA #26:JSR oswrch  \VDU 26
  100 LDA #6:LDX #255:LDY #0:JSR
osbyte  \*FX6,255
  110 LDA #3:LDX #10:LDY #0:JSR o
sbyte  \*FX3,10
  120 LDA #27:JSR oswrch:LDA #85:
JSR oswrch:LDA #1:JSR oswrch \VDU
 27,85,1
  130 LDA #27:JSR oswrch:LDA #65:
JSR oswrch:LDA #2:JSR oswrch \VDU
 27,65,2
  140 LDA #1020 MOD256:STA y:LDA
#1020 DIV256:STA y+1  \y=1020
  150 .loop
  160 LDA #10:JSR oswrch  \VDU 10
  170 LDA #27:JSR oswrch:LDA #76:
JSR oswrch:LDA #960 MOD256:JSR os
wrch:LDA #960 DIV256:JSR oswrch \
VDU 27,76,960 MOD256,960 DIV26
  180 LDA #0:STA x:STA x+1  \x=0
  190 .loop1
  200 LDA x:STA block:LDA x+1:STA
 block+1
  210 LDA y:STA block+2:LDA y+1:S
TA block+3
  220 LDA #9:LDX #block MOD256:LD
Y #block DIV256:JSR osword  \POIN
T
  230 LDA block+4:AND #7:TAX:LDY
mult,X  \Y=POINT*6
  240 LDX #6
  250 .loop2
  260 LDA data,Y:EOR #3:JSR oswrc
h
  270 INY:DEX:BNE loop2
  280 CLC:LDA x:ADC #8:STA x:LDA
x+1:ADC #0:STA x+1  \x=x+8
  290 CMP #1280 DIV256:BNE loop1
  300 SEC:LDA y:SBC #4:STA y:LDA
y+1:SBC #0:STA y+1  \y=y-4
  310 BNE loop
  320 LDA y:BNE loop
  330 LDA #3:LDX #4:LDY #0:JMP os
byte  \*FX3,4
  340
  350 .mult
  360 EQUB 0:EQUB 6:EQUB 2*6:EQUB
 3*6:EQUB 4*6:EQUB 5*6:EQUB 6*6:E
QUB 7*6
  370
  380 .data
  390 EQUB 0:EQUB 0:EQUB 0:EQUB 0
:EQUB 0:EQUB 0
  400 EQUB 0:EQUB 1:EQUB 0:EQUB 0
:EQUB 1:EQUB 0
  410 EQUB 1:EQUB 0:EQUB 2:EQUB 2
:EQUB 0:EQUB 1
  420 EQUB 0:EQUB 3:EQUB 0:EQUB 0
:EQUB 3:EQUB 0
  430 EQUB 1:EQUB 1:EQUB 1:EQUB 1
:EQUB 1:EQUB 1
  440 EQUB 3:EQUB 0:EQUB 3:EQUB 0
:EQUB 3:EQUB 0
  450 EQUB 1:EQUB 3:EQUB 2:EQUB 1
:EQUB 3:EQUB 2
  460 EQUB 3:EQUB 3:EQUB 3:EQUB 3
:EQUB 3:EQUB 3
  470 ]
  480 NEXT
  490 PRINT"End.....&";~P%
```

Clues to iNFiNiTY

IN this month's Arcade Corner we feature hints and tips for Superior Software's Repton Infinity, the latest and greatest in this never-ending story of that lovable green reptile. This game has been causing readers quite a few headaches, so here are some cryptic clues that should cure them – or will they cause even more?

The clues are for Repton 3, Repton 4, Robbo and Trakker. These are subdivided even further into the individual game files.

Repton 3

The name is the same, but the meaning is different. Do the Repton "juggle" and keep two in the air at once.

G.Rep3A: When in the room of the four the left one is the one to take. Don't let too many spirits out or you'll be sorry. Grab the key and stick around for a clunk on the head.

Don't let the rocks fall until you make your way back up. The sixth column hides the true way. The top transporter is the key to your success.

G.Rep3B: Use the transporter, stopping the fungus as late as possible. Although symmetrical, two puzzles are not solved in the same way. Go for the top, then back and left to avoid the monsters trapping you. They'll prevent you completing the screen if they catch up with you. The hour glass needs special care or the grains will slip through too easily

Repton 4

Copy the things that PAC more points. A copier is a copier when it is a copier? Magiblocks are magic for columns too. The jewel that runs away is the one that must carefully be collected. A spirit in a cage is one that can't be copied.

G.Rep4A: A rock needs to be transported so that it may turn magic walls to notes. When you pick up the key make sure you can run to the top to scramble those eggs. The snowflake needs to be defrosted very carefully. Transport or be crushed.

G.Rep4B: From the start move the rock over the copier so that it is copied and its copy falls into the transporter below. Believe it or not, the entire screen can be cleared. Start with the column to the left of centre and your task will be much easier. Spirits need to be photocopied very carefully or they will be dazed. Avoid those nasties entering the transporters which are meant for you.

Robbo

Kettles cool in the fridge. Fry the fish in the great white telephone. The coolers have bottomless pits for stomachs. Keep off the grass.

G.RobboA: The coffee needs pouring carefully to get the orbs. Go left. Objects pushed through pipes still work. Mow the lawn at once – the mower needs transporting twice to cut the grass. Too many spanners spoil the computer soup. Cross the pipelines with care as the traffic is heavy at times.

G.RobboB: It's a jungle out there, so use the mowers to clear as much as possible. Remember you can't push them up. If you don't like it, put it in the fridge. Not all bulbs burn bright. DISCover that fish will make THINGS vanish. One wrong step and you're run over. Everything passes before your eyes. One spanner in the works should bring most things to a halt.

Trakker

The spider is myopic. Bend a banana to bend a spider. The splats splat you as well. Put Repton to bed for a peaceful screen.

G.TrakA: Kevin is a useless lad. He is in places where you don't want him. Place him right though and he will kill the Jaggas for you. Place Kevin just right and the spiders won't worry you. Blow a hole in the wall to escape. Free Reptons with dynamite then put them to bed. A perilous maze of nasties to be trapped with the OOFs. Take the eyes to the signs.

G.TrakB: Clear the gantry so the rocket can take off. Practise your long distance road sign throwing. Be careful in the explosives shed. Detonate at the right moment and you'll kill the Jaggas.

Blow up REPTONs and there will be some left over for the wall as well. Release the Jaggas from their stone rooms to gain more points. Throw the tomatoes right or there will be none left.

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Happy days at Fun School

A new series of superb educational packages is tested in the class by Shelley Gibson

FUN SCHOOL 2 is a suite of educational programs intended for both school and home use which comes as three separate packages categorised by age range. Attractively presented, it has instant eye-catching appeal.

All the programs are colourful and simple to understand and operate regardless of the experience of the adult involved or the age of the children. It is refreshing to find that the age range label actually correlated with the children exposed to it.

There are eight programs for each age range, all adaptable to different abilities. It is also possible to set the skill level – although this seemed to be rather hit and miss – as well as adding your own choice of words for use in some programs.

Attractive teddies

The Under-6s package is especially welcome, as software for reception classes requiring a minimum of teacher interaction is very rare. These particular programs were used easily by children unfamiliar with micros and in only their second week at school.

The cursor in this first set of programs takes the form of an appealing teddy bear. He rewards correct responses with an amusing caper and the accompanying music is neither irritating nor too long.

Favourite of the reception class was undoubtedly Teddy Count in which various numbers of teddies parade around the screen leaving the child to identify their number. Very simple and extremely useful.

A wrong response results in the teddies lining up to be counted and stepping forward one by one. If the child still can't count them they are counted for him.

Running a close second in popularity came Teddy Bear Picnic – a simple case of guiding Teddy through a maze using the arrow keys until he is reunited with his food.

Colour Train was very popular. A train chugs around a varying size track towards differently coloured stations. Hit the spacebar when the colour of the station matches that of the train.

Also included is Find the Mole. With five sizes of molehill numbered one to five, the child must guess the one which hides the mole. If it is in a smaller hole the word *lower* appears on the screen. Should he be lurking in a larger one then *higher* is the prompt.

Pick a Letter tests lowercase letter recognition and spelling. Using the cursor keys Teddy must be guided to pick up letters.

Spell the Word is a variation on that old chestnut Hangman, but with the addition of pictures as clues. It would have been even better if it had kept to one-vowel sounds and three letter words, as it tends to jump around in phonic terms, and random words were

Use the robot to fill the hole with the pieces

Spend your money wisely on souvenirs

occasionally repeated in close succession.

It was necessary to provide the children with a written list of words to stem the flow of "How do you spell..." queries.

Shape Snap is another simple exercise. Shapes appear and if they are different you press any key except the spacebar, which you use if they are the same. Getting the match right makes them flash along with a congratulatory tune. However, they flash in different colours, which means that they no longer match – a little confusing for some younger children.

The only program that was not used in school, but will probably find its niche at home, is Write a Letter, a very simple text editor. It still has the age old problem of a keyboard in capitals and the screen in lowercase.

This can often lead to children not understanding the connection between their actions and the result. I feel that this particular program would have been more at home in the 6-8 year olds' package.

Jump to it

The next age group is for 6 to 8-year-olds. Here the cursor is an endearing frog which behaves in the same manner as the teddy. Number Train replaces Colour Train and is basically the same except that at each station passengers alight and board asking the children to input the new number of travellers.

Picnic becomes a Maths Maze full of robots posing mathematical calculations and Hangman becomes Caterpillar. Shopping is a very simple problem exercise requiring little reading skill. Given a shopping list and a row of four shops, you must guide the frog into the correct one for each item.

In Packing an assortment of shapes must be fitted into a rectangle. Treasure Hunt introduces coordinates and a warmer or colder technique to let children locate buried treasure on an island which has been overdrawn by a grid.

My only criticism is that it has letters rather than numbers on one axis – although this can be a plus for children starting to use coordinates.

A nice tables game called Number Jump encourages children to make the frog jump across the screen, landing on multiples of a specified number.

Finally in this package is Bounce. I found it difficult to achieve the correct blend of coordination and logical thinking it required. The idea is to bounce a ball off a wall in such a way that it avoids obstacles. The angle of the initial throw can be changed as well as the starting position. It sounds easy, but I found it fiendishly difficult.

The Over-8s package is intrinsically different in that the first seven games all provide a keyword if completed and this is used in the last program. Again you can see that some of the games are progressions from earlier ones – Build a Bridge from Packing, Passage of Guardians from Maths Maze.

Build a Bridge is more complicated than its predecessor in that triangular shapes may need turning over for correct placing. In Passage of Guardians you are asked to solve anagrams instead of sums – some are very difficult. It suffers from too frequent repetition of some words.

Unicorn combines a simple maze/coordination game with the old fox, hen and corn conundrum. This took the children quite a long time to solve.

Logic Doors had my brightest fourth year juniors stumped for quite some time. It's a maze game requiring careful mapping, made deviously difficult by the introduction of one-way doors which are different colours on each side.

Furthermore, to gain a keyword it is necessary to play a second time using keys. This is much more difficult as the route needs to be planned in advance to make sure you have all the necessary keys to finish.

Souvenirs, on the other hand, was refreshingly simple. Your task is to travel to various European countries spending money in each one and returning with a souvenir from each. This nice introduction to geography requires some idea of how to work out simple ratios.

Baffling binary

Code boxes involves something which few primary schools cover – binary. This really stretched the eldest, and after a lot of guesswork plus trial and error they worked out how 10 equalled two and 100 is four.

The penultimate challenge is Mystery Machine with knobs to turn, levers to pull and a key. All are coloured and must be moved in the correct order. The instructions are in a code that must be cracked. By now the whole class were dab hands at problem solving and soon had everything operating.

Last comes Escape – yet another maze with horrifying memories of Logic Doors. Again, careful mapping is needed. Here you must use the collected keywords, but beware of backtracking as words can be used once only.

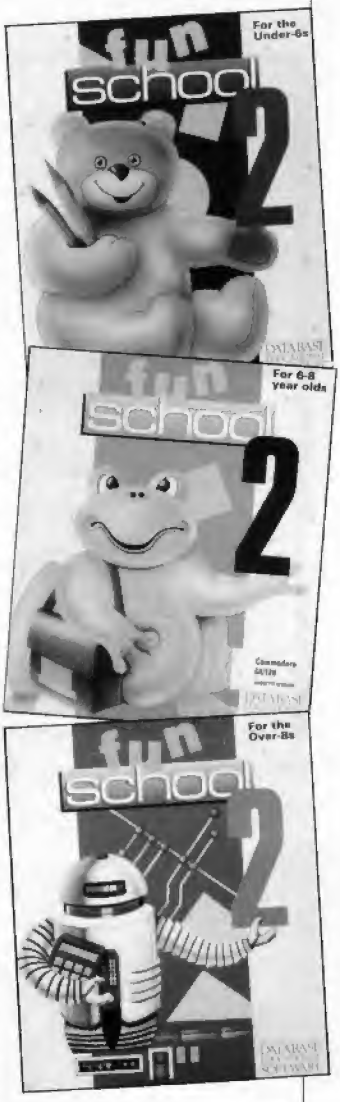
Respond with the correct keyword at each stage and you have finished – rather an anticlimax, but only because there was no more to do.

The children – and staff – found Fun School 2 great educational entertainment. It's a must for anyone with children and an Electron.

Fun School 2 is available on tape for the Electron, but the BBC Micro disc version will run if you have a DFS filing system and you disable the Plus 1 by entering the following Basic routine:

```
*FX163,128,1
?&212=?&212
?&213=?&213
?&2AC=0
```

This could be inserted into the !BOOT file to save typing it in each time you run a program.



Product: Fun School 2 (Under-6s, 6-8s, and Over-8s)
Price: £9.95 each
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Taking the broad view

Janice Murray reviews a new book aimed at computer enthusiasts

HUNDREDS of books are now available to the computer enthusiast, some aimed at a particular micro, but others, like the Computer Hobbyist's Handbook reviewed here, are more general in nature. So what is in it for the Electron user?

The first chapter discusses the various microprocessors that have come and gone over the past 15 years and tries to predict what the next ones will be like. Starting with the now ancient Intel 8080 chip, progressing via the 6800 to the Electron's Mos technology 8 bit 6502 and then on to the Achimedes 32 bit Risc chip briefly examining the Z80, 6809, 8086 and 68000 along the way. It's fascinating reading.

Chapter two moves on to interfaces, starting with the Electron's – and almost every other computer's – Centronics printer port. Next is the RS232 port, and although the Electron doesn't have one built in, several have been available from third party suppliers over the years.

A wiring diagram of the RGB socket is useful to anyone making up or repairing their own monitor lead. The analogue port wiring diagram will help those intending making simple interfacing projects for their Electron.

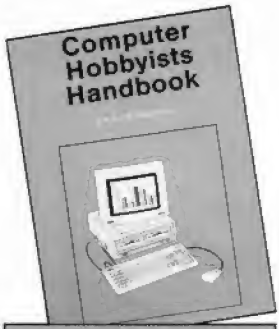
Moving on to languages in chapter three, machine code, assembly language, Basic, Logo and Pascal are all given equal space and there's a brief look at some of the lesser known ones.

Anyone needing to brush up on their binary ones and twos complement, hexadecimal and all the other number bases will find a helping hand in chapter four.

Chapter five discusses operating systems, though not the Electron's. However, it is still interesting. The following chapter on graphics talks only in general terms, not specifics so there's no problems there.

A glossary of technical terms makes up chapter seven and this is useful as it ignores the common ones you probably know already and concentrates on some of the latest buzzwords being used. Here you'll find explanations of blitter, CAD, co-processor, multitasking and object oriented, to name just a few.

While the book contains nothing specific to the Electron, it is a mine of useful general information. Ignore the illustration of the Amstrad PC on the cover – it's just as good for the Electron user.



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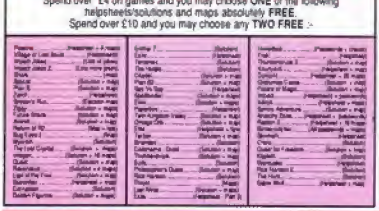

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"The 3D perspective graphics are stunning" *Electron User GOLDEN GAME June 89*
"Holed Out is great.....The game plays very well and the graphics are superb." *Popular Computing Weekly, March 1989*
"The best golf simulation I've ever seen on any Acorn machine." *The Micro User, June 1989*
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